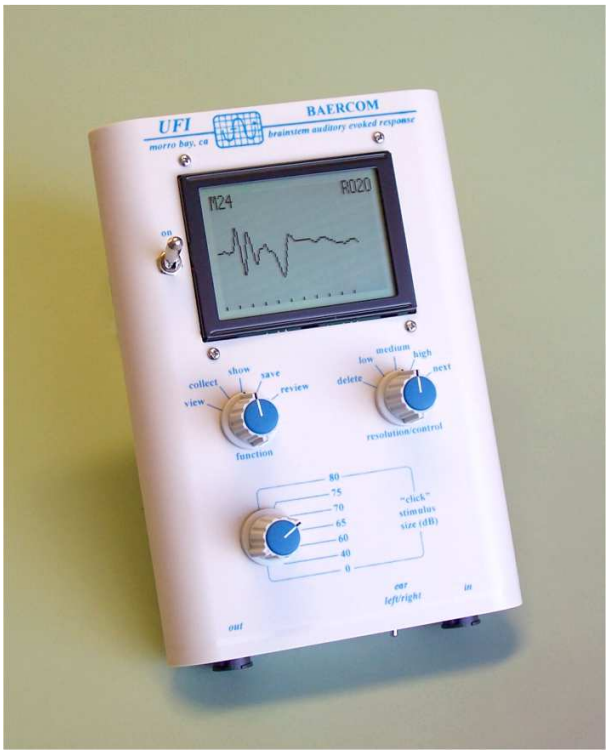
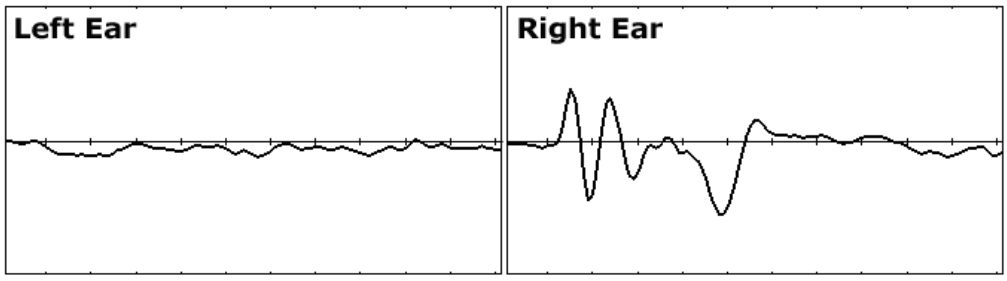
UFI *BAERCOM* ™

Firmware v D.2 and *BAERCOM-PC* Software v 2.2

Instruction Manual 2.2

April 2016





BAERCOM traces from one-year-old Dalmatian with unilateral hearing loss (left ear).
Test time: less than 5 minutes.

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545 Main Street, Ste C2
Morro Bay, CA 93442

Ph: 805-772-1203
Fax: 805-772-5056

www.ufiservingscience.com
mail@ufiservingscience.com

Recent Enhancements to the Baercom system!

We continue to invest in the overall Baercom system to make it even better. Within the last year, we have revised both the Baercom operating firmware (which is now vD.2), as well as the Baercom-PC software (now v2.2). Both of these recent upgrades supply the following enhancements:

- Mirror Trace addition to include TWO Baer traces in each trace area – Most records bodies now require TWO Baer traces for each ear of the animal. If it is the Baer you are seeing, the results will look very similar each time you perform a collection. Taking two traces for each ear is just a good idea. The Baercom-PC software now includes the ability to post TWO Baer traces in each of the two trace areas. Report saving, printing, and clipboard transfers will include both traces when present. And this capability works with ANY USB based Baercom, NOT just the latest version! (4.5.1)

- Full Trace Memory Download with Trace Browsing (with v D.2 F/W) – This latest Baercom-PC software can now check to see if your Baercom Firmware is v D.2. If it is, the software quickly downloads ALL BAER TRACES currently in the data memory of your Baercom! That's not all; you can then call up a BROWSE window to quickly browse all 32 traces! And just double-clicking over the desired trace adds it to the Report window, on the side you choose! (4.3, 4.5.2)

- Trace Stacking Window for Comparison or Report (with v D.2 F/W) – As mentioned above, many records organizations want two BAER traces for each ear. This is just a good idea! The Baercom-PC software includes Trace Stacking; allowing multiple BAER traces to be stacked up, one on top of the other, in the same display window. You can stack up to five Baer traces, and color-coding keeps everything straight. Still, this single report window can hold 2 Left Ear and 2 Right Ear traces! Trace Stacking lends itself to many other possibilities as well. (4.5.3)

- Direct Baercom to PC Software download capability – This latest version of the Baercom-PC software takes a largely 'hands-off' approach to both the four text windows and the Baer Trace windows as well. Now, you can create a template Report file, with most of the text in place, load it in, then add Baer traces, some animal specific text additions and you are done!

In addition, the BAER Trace areas are only cleared by the first 'Locate' process. This allows you to disconnect the Baercom USB cable, take the Baercom to your animal and collect the Baer trace, connect the USB back up, Locate then download the just collected Baer trace, disconnect the USB, and repeat this whole process for the other ear. If you prefer this approach, you can go straight from the Baercom to the Report without saving any Baer traces in Baercom memory. (5.3)

- Printer Orientation unlocked for Printing – Printing Orientation depends only on what you select in your Printing Preferences window. And both Print functions now also place a screen image in the Clipboard. (4.9)

- Latest (v D.2) Firmware Enhancements – We have expanded the internal BAER Trace memory from 23 to 31 traces (32 is the Sample trace). Also, we added a **single action Erase All** command so you can clear all Baer Trace memory in about 30 seconds! (2.4.2.4)

Please visit the Baercom home page:

www.ufiservingscience.com/baercom.html

Links at the top of this page also take you to some more detailed explanations! In addition, the Baercom page includes information on upgrade options for your Baercom if you are interested. And keep checking back here! Any future 'late breaking news' will be posted here as well.

How to use these instructions

How should you use these instructions? Before doing anything with the BAERCOM, you should block out a 2-3 hour period of undistracted time to carefully read through this instruction manual, start to finish. The BAER process is complex. Acquiring a good EEG signal is challenging on a good day, requiring substantial attention to detail. The BAERCOM is a totally new instrument to you, and you will need to develop new skills or hone existing ones to master its use. And your task is to determine if the squiggles you see are noise from electrode issues, or are the correct BAER peaks and valleys. And you need to develop a totally new work-flow within your practice or work area to accommodate the BAER testing process. Carefully taking in the details in these instructions will go a long way to help you to quickly be able to use the BAERCOM effectively.

These instructions are intended to follow a natural progression; from exploring the scientific phenomenon being evaluated (the BAER signal in the animal's EEG, section 1), to the use of the BAERCOM unit by itself (section 2) to observe this phenomenon, followed by installation (section 3) and a discussion of the BAERCOM-PC software that extends the capabilities of the BAERCOM system (section 4). All these details are pulled together in the last section (5) where a few different overall approaches are supplied to familiarize you with the use of the BAERCOM.

We have fielded calls that went something like this: "I just got my Baercom, and have a litter of puppies scheduled for test in three days. Where do I start?" We helped each of these customers come up to speed as quickly as we could. But in general, placing yourself 'under the gun' like this is just not a good idea. You should take your time as you work through these instructions. And your first session actually using the Baercom should be on a single animal in a relaxed setting with as little pressure and as few other distractions as possible. You will probably master these new skills the best by taking this approach.

Legal Disclaimer

If you are an individual interested in purchasing the BAERCOM, please check with your local veterinarian to see if there are any legal issues involved. In many locations, you can probably do anything you wish with your own animals, including BAERCOM testing. However, if you charge a fee for BAER testing of another person's animals, you are likely required by local law to be a licensed veterinarian -- a point on which we fully agree. We urge complete and full compliance with any local laws relating to BAER Hearing Testing in your area !!!

BAERCOM User Due Diligence

When used correctly, the BAERCOM can easily show the EEG/BAER tracing for normal hearing on the selected Ear of an animal. Like most EEG/BAER instruments, the successful use of the BAERCOM requires both a substantial familiarity with the meaning and appearance of the EEG BAER signal, as well as a methodical "attention to detail" approach to instrumenting and testing an animal. Thus a certain amount of "due diligence" is required of the BAERCOM user in order to successfully use the BAERCOM. Failure to master either or both of these two key areas can result in poor data that is incorrectly interpreted, but this should not be taken as the fault of the BAERCOM system.

Radiated Noise Caution

We recommend that you disconnect the BAERCOM from the PC computer (by disconnecting the USB cable from the USB connector on the top panel of the BAERCOM) before actually collecting BAER data from an animal. The gain of the EEG signal conditioner in the BAERCOM is very high, and power supplies (especially external supplies used with Notebook computers) can introduce a substantial amount of electrical interference, that can easily distort or mask the actual EEG/BAER signal that the BAERCOM is designed to measure.

UFI Interpretation Requests

UFI continues to work with a number of licensed DVM's in both the development and support of the BAERCOM. However, UFI does not have a licensed DVM on staff. As a result, we are not able to interpret your BAER data for you. We may, at times, ask that you send us some of your BAER data, but this is only for evaluation regarding connection and signal quality issues.

Directional Consistency

These instructions repeatedly use the designations **right** and **left**. You can understand these directions as viewed from either the front of the animal (your right and left), or from the back of the animal (the animal's right and left). Using the animal's right and left makes the most sense, since the report documents the animal's hearing. **Whatever approach you choose, use it *consistently*.**

Table of Contents

BAERCOM™ Overview

The BAERCOM system was conceived in 1999 as a low cost, “field-friendly” Brainstem Auditory Evoked Response (BAER) testing system. The complete system draws on areas where UFI has extensive expertise. These fields include physiological signal conditioning electronics, microprocessor-based data collection, PC software development, and user-friendly packaging for small instruments.

The main component of the BAERCOM system is the BAERCOM unit itself. This compact instrument generates audible "clicks" that are used to stimulate the acoustic nerve, initiating the BAER data response. (For details on this process, see Section 1, “An Introduction to the BAER Process.”) The BAERCOM also incorporates EEG signal conditioning circuitry to filter and boost the weak EEG signal, as well as analog-to-digital and data handling circuits.

The heart of the BAERCOM unit is a microprocessor. The microprocessor generates carefully timed sets of 100 clicks that are sent to an earphone in one of the animal’s ears. The BAERCOM User can adjust the click volume level if desired. For 11 milliseconds after each click, the microprocessor supervises collection of the amplified and filtered EEG auditory response to the click stimulus.

The BAERCOM microprocessor then compiles the digitized BAER data for each of the 100 stimulus-response sets (we refer to these 100-click data compilation passes as “scans”), and then sums this Scan data with the overall BAER response data received previously. As the scans accumulate in the BAERCOM’s working memory, they evolve into a complete BAER trace -- you can actually watch the BAER trace take shape on the graphical display. Also, up to 31 individual BAER data traces can be stored in memory ”pages” inside the BAERCOM.

The BAERCOM-PC software rounds out the simple functionality of the BAERCOM system. The BAERCOM unit can send individual BAER traces through a standard USB cable to your PC, where the BAERCOM-PC software pairs two or four traces together in a simple Report format for easy review. The BAER test Report can next be annotated, saved to a file, printed, and/or moved to the clipboard for other applications to use. Finally, the BAERCOM-PC software can load previously saved BAER reports back into the software for additional review, printing, etc.

BAERCOM Vision Statement

Our vision for the BAERCOM is a simple, affordable alternative to regional BAER test centers for *basic* animal auditory testing. The BAERCOM was not, and is not, meant to replace the rigorous BAER testing capabilities of the regional centers. Instead, the BAERCOM permits an individual owner, breeder or small veterinary practice (our main customer base) to *screen* for hearing abnormalities. A "positive BAER test," meaning one that shows no hearing impairment, can be clearly evident with the BAERCOM. Should issues with hearing be surfaced by the BAERCOM, these animals can be re-tested at a later date, referred to a regional test center, or both.

The expensive audiological testers at the regional centers usually provide multiple click-stimulus frequency options and a very wide amplitude range. Instruments at the centers often offer "bone stimulation" capabilities, among other things. By contrast, the BAERCOM supplies just one stimulus frequency option, a simple wideband click with an adjustable amplitude (SPL) up to about 80 dB. Also for simplicity's sake, the gain and pass band of the BAERCOM EEG signal conditioner are fixed.

The magnitude of the BAER response from your subject depends on how many "scans" (sets of 100 data collection passes) you allow the BAERCOM to make before you stop the test. For most small animals, 20 scans are usually sufficient to distinguish a positive BAER outcome.

The BAERCOM unit is packaged in a durable ABS plastic case just 1.4" x 5" x 7" in size (35mm x 125mm x 180mm). It features an easy-to-read LCD display, and storage capacity for up to 31 separate BAER tests in internal memory. A 9V alkaline battery provides the power, making the BAERCOM truly portable. A standard USB connection simplifies interfacing to a PC computer for later data retrieval and printing.

These features permit animal hearing evaluation and research in locations where more expensive testers would be impractical or even impossible. A few of our outback customers in Australia, hundreds of miles from testing centers, offer an extreme example of situations where the BAERCOM is invaluable.

Simple, portable, affordable animal hearing screening – that's the BAERCOM!

Section 1: An Introduction to the BAER Process

By: D. Colette Williams, PhD candidate
Veterinary Medical Teaching Hospital
University of California, Davis

In the late 1960s, Jewett used signal averaging to record the brain electrical activity that resulted from auditory stimulation in felines.[1] A series of positive peaks were identified and attempts were made to correlate these with specific anatomic structures. Further studies led to this generally accepted model (Figure 1).

Commonly referred to as the Brainstem Auditory Evoked Response (BAER) test, in some publications the R is replaced by a P (for Potential). Other aliases include, ABR and BSER. The peaks are designated by Roman numerals but their appearance varies with electrode placement.[2] In most of the veterinary literature there is agreement on peaks I, V, V_N (a trough appearing after peak V), as well as, VI and VII (when present), but there are some discrepancies in the labeling of the remaining peaks.[3]

In veterinary medicine, the BAER is most often used to screen dogs for congenital deafness. Numerous breeds are at risk for this disorder and in the vast majority it is related to coat color, or lack thereof.[a,b] It is a sensorineural deafness which results from cochlear hair cell degeneration. On BAER all peaks should be present and at the appropriate latencies upon testing of ears deemed normal while those considered deaf should have flat tracings (Figure 2). On occasion, there may be residual hearing in some young puppies which will appear as small, late peaks. These are thought to represent a degenerative process that is not quite complete. Retesting a few weeks later will usually result in flat tracings.[4] In rare cases, results may not be clear cut. BAERs may be asymmetrical when comparing ears or both may be abnormal for no apparent reason.

The BAER can also be used to examine hearing in patients suspected of having conductive deafness. Debris in the canal, thickening or perforation of the tympanic membrane, sclerosis of an ossicle or fluid in the middle ear can result in this condition. On BAER this is demonstrated by decreased amplitudes and prolonged latencies (if severe, they may be flat). If this is the case, repeating the test with increased stimulus intensities should result in improvements in the BAER (higher amplitudes and shorter latencies). Fortunately, many cases of conductive deafness can be treated, so the prognosis of return of function is often favorable, in contrast to sensorineural deafness which is incurable. Some medications are ototoxic and can cause sensorineural deafness if they reach the inner ear.

Presbycusis is an age-related deafness that is seen in older dogs. Primarily considered a sensorineural deafness, in some dogs it may also have a conductive component so BAER results can vary.

A few other uses for the BAER are to help differentiate peripheral from central vestibular disease and to test brainstem function in comatose patients (though it is important to keep in mind that many insults can result in cochlear hair cell death so if no peaks are present, it won't provide this information).

In canines, the variability in the size of the cranial vault and the thickness of the temporalis muscle will impact the appearance of the BAER. The BAERCOM's MEDIUM resolution setting is ideal for most patients but in some small and/or young dogs for optimal peak amplitudes it may be necessary to use LOW (less gain), whereas HIGH (more gain) is often better for large adults. In contrast, peak latencies, the time (in milliseconds) at which each peak appears, tend to be fairly similar with the exception of very large breed dogs (i.e. Great Danes), where they are delayed. Publications give reference values for normal dogs but when comparing data it is important to note the method of stimulus delivery. In some makes of insert earphones, a length of tubing separates the sound source from the site of delivery, this results in about a 1 msec delay in all peak latencies when compared to data acquired via headphones or other types of earphones, such as those included with the BAERCOM, where the sound generator is positioned near the external auditory canal. Subtle changes in latency are difficult to see on the small BAERCOM screen but can be better appreciated after downloading the data to a PC. With printouts, the latency values can be calculated using a ruler to measure the distance to each peak and dividing that value by the distance between a pair of msec marks on the x-axis (i.e. for wave I in Figure 2 it is 18.5 mm X 1 msec/11.5 mm = 1.61 msec). Exact measurements of peak latencies and interpeak intervals are helpful when trying to assess brainstem function in vestibular or cerebellar disease cases.

One condition that is necessary for obtaining a diagnostic BAER is patient cooperation. Good electrode and earphone placement is critical. Movement and muscle artifact can sometimes appear similar to the peaks of a BAER, leading to a false positive or it can interfere with detection of the BAER, resulting in a false negative. Thus, it is important to get recordings that are fairly free of artifact. In most cases, this can be accomplished without the use of sedation. Getting the dog to relax to the point of sleeping through the procedure is ideal. Some litters of puppies can even be tested while curled up with their littermates in an exercise pen. For cases that are undergoing additional diagnostics (i.e., imaging, CSF tap, etc.), the BAER can be done while the patient is under general anesthesia. Duplicate recordings for each ear should always be performed to insure that the results are reproducible. This is an OFA requirement for all dogs entered in the congenital deafness registry.[c] Additional tests with increased stimulus intensities are recommended if abnormalities are found on routine examination. In some cases repeat tests at a later date may be warranted.

At this time the BAER is considered the gold standard for hearing testing in veterinary medicine. When performed correctly, it is a reliable test that breeders can use to help them try to reduce the incidence of congenital deafness in their breeds.[4] It also has other uses, though the limited capabilities of the BAERCOM unit make it less practical in these applications where subtle changes are the key to detection of neurological abnormalities.

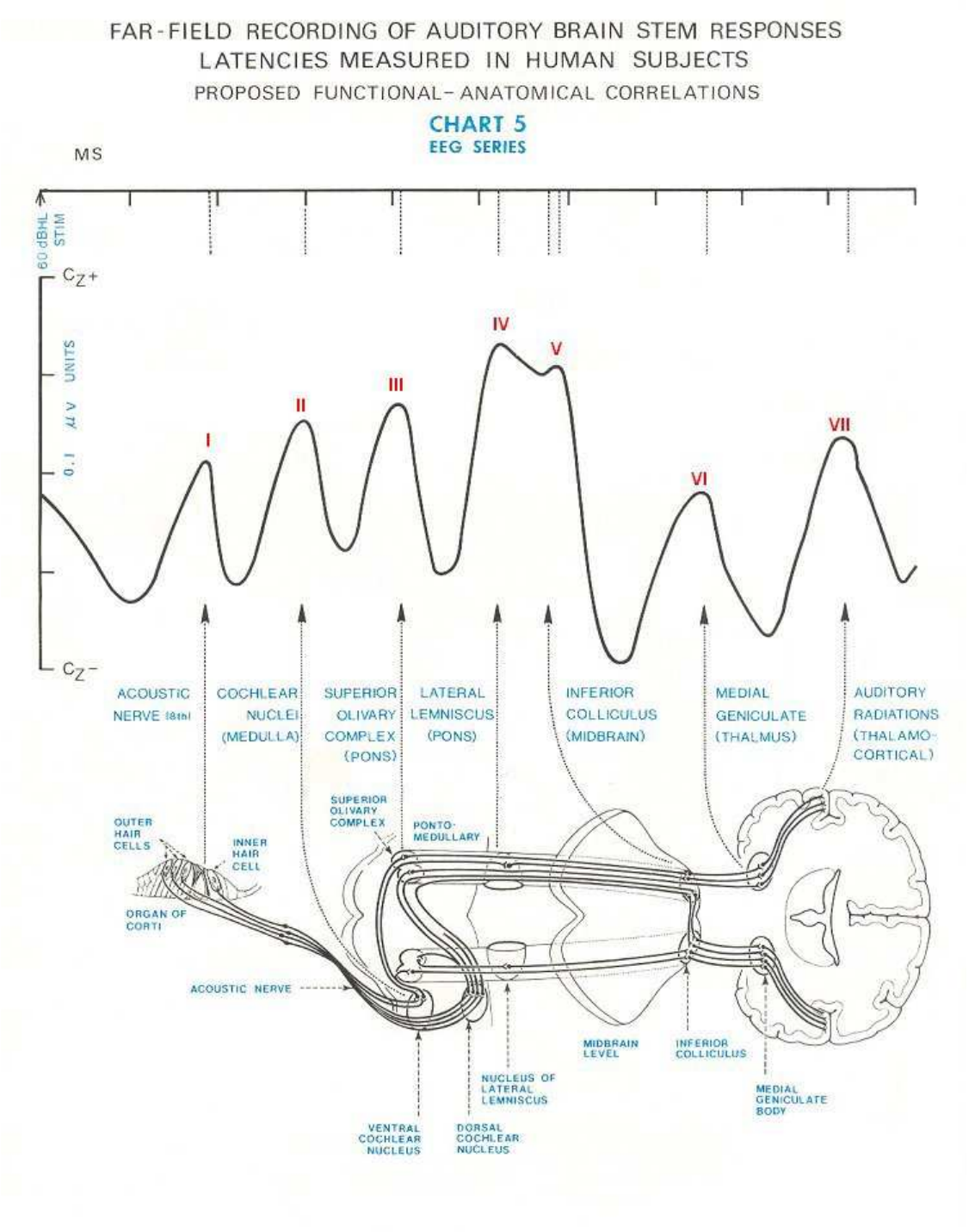


Figure 1 - diagram of the proposed generators of BAER peaks. From Stockard JJ, Stockard JE and Sharbrough FW. *Mayo Clin Proc* 52:761-769, 1977, used with permission.

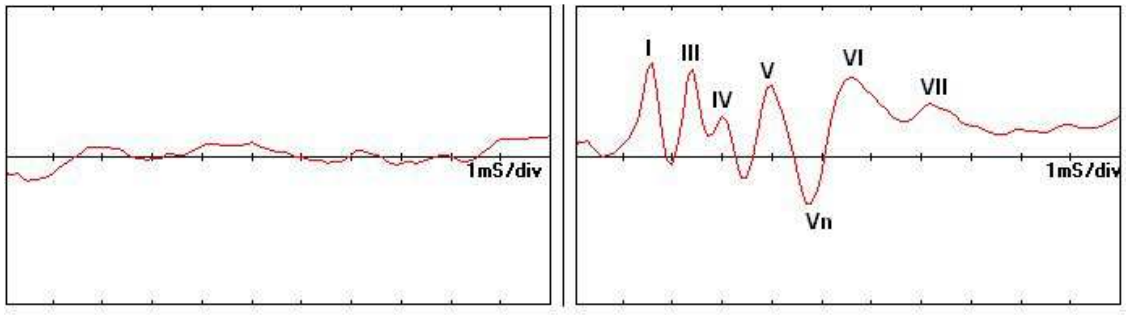


Figure 2

Figure 2 – BAER results from a six year old unilaterally deaf Australian Cattle Dog. Peak labeling is consistent with that outlined in reference 2.

[a] http://www.lsu.edu/deafness/deaf.htm

[b] http://bowlingsite.mcf.com/Genetics/ColorGen.htm

[c] http://www.offa.org/deafinfo.html

1. Jewett DL, Volume-conducted potentials in response to auditory stimuli as detected by averaging in the cat. *Electroencephogr. Clin. Neurophysiol.*, 28:609-618, 1970.

2. Holliday TA, TeSelle ME, Brain stem auditory-evoked potentials of dogs: wave forms and effects of recording electrode positions. *Am J Vet Res* 46(4): 845-851, 1985.

3. Kawasaki Y and Inada S, Peaks of brainstem auditory evoked potentials in dogs. *Vet Res Comm* 18:383-396, 1994.

4. Holliday TA, Nelson HJ, Williams DC, Willits N. Unilateral and bilateral brainstem auditory-evoked response abnormalities in 900 Dalmatian dogs in the *J Vet Intern Med* 6(3):166-174, 1992.

Section 2: Using the BAERCOM

2.0 Using the BAERCOM for Hearing testing

The "Brain-stem Auditory Evoked Response" (BAER) signal shows up as a sub-microvolt signal during the first 10-15 milliseconds after an audio "click" stimulus is presented to the ear under test. This small signal is superimposed on a fairly random background EEG signal. The EEG/BAER signal is normally taken from active electrodes placed at the top of the head and near the ear under test, with a reference electrode placed adjacent to the other ear.

As discussed in the “Overview” above, the BAERCOM is a microprocessor-based data collection and reduction module that is specifically configured to record the EEG/BAER signal. The BAERCOM includes the circuits needed to generate the click stimulus; present it to the ear; collect, amplify, and filter the EEG/BAER response, and digitally sample it. EEG data from multiple passes are rapidly collected and summed together, and the resulting BAER trace is plotted on an LCD display. BAER traces can also be sent to a PC through one of the computer's USB ports. The computer need not (and probably should not) be connected during BAER data collection, and up to 31 compiled BAER data traces can be stored in BAERCOM internal memory.

Note: As mentioned above, these instructions repeatedly use the designations **Right** and **Left**. You can understand these directions as viewed from either the front of the animal, or from the back of the animal (the animal’s right and left, preferred). **Whatever approach you choose, use it *consistently*.**

2.1 BAERCOM block diagram and theory of operation

Every effort has been made to keep the BAERCOM circuitry as simple and compact as possible. Figure 1 shows a block diagram for the BAERCOM, and the general function of each block is discussed in the following sections.

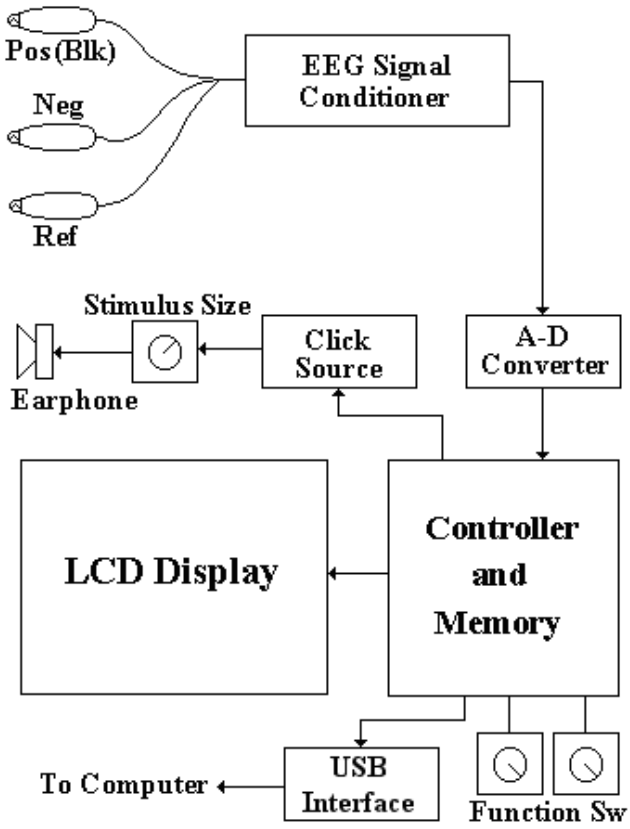


Figure 1. BAERCOM™ block diagram

2.1.1 Click source and earphone

In order to collect the BAER response, an audio "click" must be presented to the ear under test. The click source circuit generates this signal, and is precisely timed by the controller. You can also adjust the **"click" stimulus size** control on the BAERCOM front panel to set the amplitude of the click signal, which is calibrated in dB. We have found that a setting of between 60 and 70 dB is generally sufficient to produce a good BAER response. The click signal is supplied to the three-pin "**out"** connector on the left side of the BAERCOM bottom panel.

The **earphone**, which plugs into this connector and is inserted into the subject's ear canal, converts the electronic click signal into an acoustic stimulus. The earphone ends in a soft plastic cone to help contain the click within the ear canal.

2.1.2 EEG input assembly

The EEG signal is normally measured using two "active" connections (positive and negative), with a third Reference connection. This means that 3 connections / electrodes are required on the subject for a single EEG channel. In order to minimize the number of electrodes placed on the animal, the BAERCOM uses just 3 connections for BOTH ears / channels. While not shown in the above block diagram, the BAERCOM does this by allowing you to switch two of the 3 EEG channel connections between a Reference connection and an Active Input connection.

The BAERCOM EEG **Input Assembly** has a four-pin plug on one end and a molded plastic block with three labeled and color-coded **safety jacks** on the other end. The jacks can be used with either alligator-clip leads connected to disposable hypodermic needles as electrodes, or reusable needle electrodes. (See Section 2.3.2.)

The BAERCOM ships with a matching set of three, 8-inch (20cm) alligator-clip leads plugged into the safety jacks. The plastic covers for these clips are also color-coded. ***Make sure the cover color of each alligator-clip lead matches the color shown on the label fastened to the molded block.***

An Ear Select toggle switch (mentioned above) is labeled "**ear left/right"** and is located on the right side of the BAERCOM bottom panel. This switch permits you to select the desired ear to test, and routes the EEG Inputs and Reference connections accordingly, based on the position of this switch. For valid connections, you must place the alligator clips on the ***disposable*** needles as follows:

- ***Black clip*** on (positive) needle on the ***crown (top)*** of head;
- ***Yellow clip*** on (negative/reference) needle near ***left ear***.
- ***Red clip*** on (negative/reference) needle near ***right ear***;

Note that three ***reusable*** needle electrode leads are also included with your BAERCOM. Since these needle electrodes are re-usable, they should be sterilized between each use. The needles at the ends of these leads are placed on the subject as discussed in Section 2.3.2.2, and are similar to the connections indicated above, except that the color of the ***reusable*** needle electrode leads **may or may not** match the colors shown on the molded block label. ***Rather than go by the lead colors***, make sure each reusable needle lead connects the proper safety jack to the proper electrode ***location*** on the animal. Electrode locations are marked near each safety jack on the molded block label. See section 2.3.2 for more information about this.

Note that the [a] placement and connection of the electrodes, the [b] setting of the Ear Select switch, and the [c] placement of the Earphone in the Ear Canal, <u>MUST ALL AGREE</u> in order to correctly sense the BAER signal for the specific ear being tested!!!

2.1.3 Internal circuits

The EEG signal conditioner block substantially amplifies the very low level EEG signal and also filters it using characteristics that favor the BAER response frequencies and minimize others. In the next block, the A-D converter transforms the analog EEG/BAER signal into digital data at very high speed. This conversion process is carefully timed to output digital data during the entire 11 milliseconds – one pass -- following the start of each stimulus click.

The microcontroller triggers the audio click and supervises high speed collection of the evoked EEG/BAER response data. The microcontroller also averages together (compiles) successive EEG/BAER data passes to generate the BAER trace. The controller generates the BAER trace that is plotted on the LCD display and can also transmit it to your PC through the BAERCOM USB connector. The controller also manages the optional saving of BAER trace data to "pages" in non-volatile memory inside the BAERCOM.

Finally, the microcontroller scans the three BAERCOM control switches frequently to check for any settings you change. This allows you to control the BAERCOM, for real-time data viewing, data collection and showing, or saving data and reviewing it. Section 2.4 goes over all these functions in detail.

The LCD graphics display permits the BAERCOM to work as a stand-alone instrument. The LCD display can show the raw EEG signal from the signal conditioner so that you can evaluate initial electrode connection quality and make adjustments if necessary before you start collecting data. The LCD also shows the BAER trace, both during and after the BAER collection process. While the BAERCOM is collecting BAER data, the display updates after every 100 passes (together called a "Scan") to show the cumulative BAER trace of all passes so far. You can also view previously recorded BAER data traces on the LCD as well. The LCD also posts various text messages that allow you to interact with the BAERCOM unit and manage the data saving process. (Note that the BAERCOM-PC program can significantly extend the capabilities of the BAERCOM system, see sections 3 and 4 for more information.)

2.2 BAERCOM battery, controls, connectors and display

The case and control layout of the BAERCOM was designed with ease of use in mind. A simplified drawing of the BAERCOM case is shown in Figure 2 below, and the location and function of each item is then discussed.

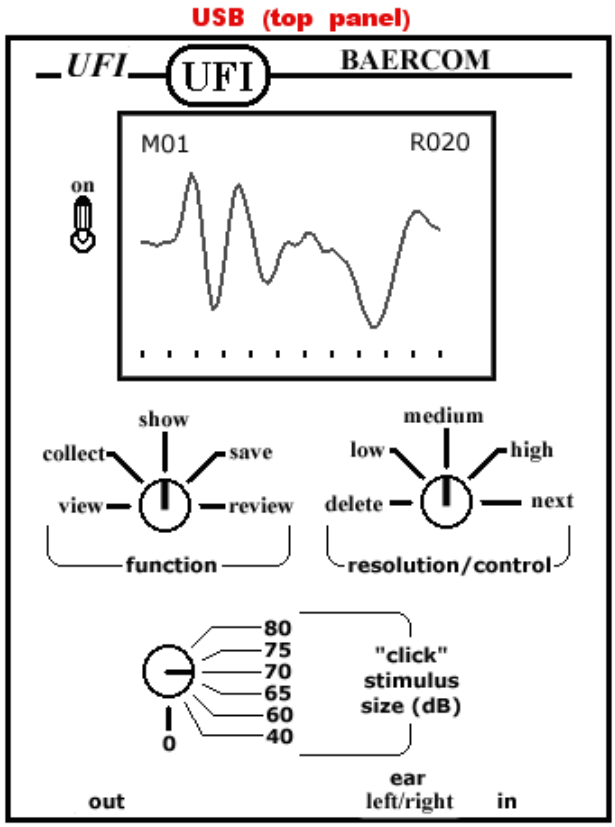


Figure 2. BAERCOM™ case front panel (simplified)

2.2.1 Battery pocket and battery replacement

A “battery pocket” is inset into the back panel of the BAERCOM. You can open the pocket by locating the short side of the cover door with the 3 raised ribs, and pulling this end of the door AWAY from the BAERCOM back panel. Once freed, the cover should swing open revealing the 9V battery.

The BAERCOM checks the battery level whenever you change the **Function Switch** position. When the level of the battery drops below about 6.0 volts, the BAERCOM stops operation and posts a "Low Battery" message on the display.

Follow this procedure to replace the BAERCOM 9V battery.

1. Be sure the BAERCOM **power switch** is turned to OFF.

2. Carefully turn the BAERCOM face down, locate the door to the **battery compartment** on the back panel, then pull the short edge with the 3 raised ribs away from the back panel to uncover the battery.

3. Hook a fingernail or other pointed object under the edge of the battery and gently pull it out of the compartment with the snap connector still attached. (If you carefully and briefly turn the BAERCOM face up the battery will often fall out on its own.)

4. Unsnap the connector from the battery by placing your thumb on a long side of the connector, then pressing the connector away from the top of the battery. **DO *NOT* REMOVE THE BATTERY CONNECTOR BY PULLING ON THE WIRES!**

5. Snap a fresh, *good quality* 9-volt alkaline battery (Duracell MN1604 or equivalent) to the connector. (Many batteries marked "Heavy Duty" have significantly less power capacity than the MN-1604, and will not last as long.) Carefully rotate the battery if necessary so that the snaps on both connectors will mate (small to large) then push the connector onto the battery.

6. Insert the new battery with connector back into the battery compartment, **making sure that the battery lead is able to lay flat along the floor of the battery pocket**, and is NOT all bunched up at one end. The wired side of the connector will be facing down.

7. Snap the battery door closed, making sure no wires are pinched as you do so.

(Note that new Baercoms are shipped with a fresh 9V battery already installed.)

2.2.2 BAERCOM Control Switches

Three rotary switches and two toggle switches allow the user to interact with and control the BAERCOM. The following five sections outline the use of these controls.

2.2.2.1 Power Switch

The BAERCOM power switch is a “locking toggle” switch located on the front panel to the left of the BAERCOM display. The shaft of this switch must be pulled ***away*** from the BAERCOM front panel in order to toggle the switch from one position to the other. This locking mechanism prevents accidentally turning the power on or off. Toggling the switch ***up*** turns the BAERCOM ***on***.

2.2.2.2 Function Switch

The BAERCOM **Function** S**witch,** on the left side of the front panel below the LCD display, allows you to choose one of the five BAERCOM main ***functions***. These functions are as follows:

- **VIEW:** The BAERCOM continuously plots the raw EEG signal acquired by the BAERCOM with no audio stimulation. The simple "scope" display with this function lets you evaluate the electrode connections and make changes if needed.

- **COLLECT:** The BAERCOM generates audio clicks and collects EEG data for 11 milliseconds following the start of each click. BAER data from each 100 passes are rapidly compiled into scans, summed with previous trace data, and plotted. The ear being tested and the number of scans so far, is shown in the upper right corner of the display. The COLLECT function allows compiled traces to be viewed using one of three vertical resolutions; low, medium and high, selected with the **Resolution/Control Switch** (next section), but we recommend using medium during trace collection.

- **SHOW:** The BAERCOM stops collecting, and posts the final, compiled BAER data trace. Note that you can choose different screen resolutions with the Resolution/Control Switch in SHOW, too. The BAER trace data is also sent to your PC through the BAERCOM USB connector during the SHOW function.

- **SAVE:** When you move the Function Switch from SHOW to SAVE, you can place the compiled BAER trace data, as shown on the display, into BAERCOM internal memory. Up to 31 such BAER data traces may be saved in bins or “pages” in internal memory for later reference and/or downloading.

- **REVIEW:** This function allows you to move BAER traces already stored inside the BAERCOM, back to the BAERCOM LCD for further evaluation or for downloading to your PC. Stored data traces can be erased as well as displayed using REVIEW.

2.2.2.3 Resolution/Control (R/C) Switch

The operation of this secondary control switch, located on the right side of the front panel below the LCD display, depends on the Function Switch position:

- **VIEW:** The R/C Switch is inactive.

- **COLLECT and SHOW:** Use the R/C Switch to select the trace display resolution, LOW, MEDIUM, or HIGH. Other R/C switch settings are inactive while the Function Switch is set to COLLECT or SHOW.

- **SAVE and REVIEW:** Use the R/C Switch in saving BAER traces, navigating through saved traces and for deleting traces.

2.2.2.4 "Click" Stimulus Size Switch

Located at bottom left of the front panel, this control sets the click amplitude (audio volume) level. Levels include 0 dB (no click), 40 dB, and then range from 60to 80 dB in 5 dB increments. You can generally start with 70 dB and then adjust as needed to start "growing" a discernible BAER trace.

2.2.2.5 Ear Select Switch

Located toward the right end of the bottom panel, this switch connects the electrode leads on the animal to the proper EEG signal conditioner inputs for the ear being tested. This switch also tells the BAERCOM which ear is currently selected for testing, information that is added to saved BAER data traces. Moving the switch handle to the Left selects the Left ear. Move the handle to the Right for the Right ear.

2.2.3 Connectors

The BAERCOM is equipped with three connectors, two that support the BAERCOM unit itself and one for connection to your computer. The next three sections describe connector use.

Both the "**in**" and "**out**" connectors use the Switchcraft EN3 family of keyed, locking connectors. These connectors require proper alignment of both the key-way and (usually) the locking collar, before full insertion can be made. Pulling on the leads during connector removal can damage the connector wiring, and so should be avoided. ***Note that for older BAERCOMs, the key-way was towards the BAERCOM front panel (up), and for current BAERCOMs the key-way is away from the BAERCOM front panel (down)!***

2.2.3.1 Input Assembly connector

The ***four-pin*** "**in" connector** for the Input Assembly is located on the right side of the BAERCOM bottom panel. The mating and locking plug on the end of the EEG Input Assembly lead should be inserted here.

A key on the input assembly plug requires proper orientation before the plug can be inserted into the "**in**" jack. **The Key-way should be down for current Baercoms!** The ***locking collar*** on this ***four-pin*** plug must also be rotated properly before the plug will insert fully into the jack. Once fully inserted, rotate the collar ***clock-wise to lock*** the plug into the jack. Rotate the collar ***counter-clockwise to release*** the plug.

2.2.3.2 Earphone output connector

The ***three-pin* "out" connector**, located on the left side of the bottom panel, accepts the ***three-pin*** plug on the earphone lead. Insert, lock and release this plug as described above for the Input Assembly plug.

2.2.3.3 USB connection to computer

A standard **USB jack** is located roughly centered on the BAERCOM ***top*** panel. This jack allows you to connect the BAERCOM to a PC USB port using the standard **USB cable** provided. The BAERCOM supplies BAER trace data via USB to the host PC whenever the SHOW or REVIEW function is selected.

The BAERCOM incorporates an industry-standard digital isolator -- the Analog Devices ADuM-1201 -- between the microcontroller and the USB interface. With a maximum rated isolation voltage of 2500 VACRMS, this isolator can enhance animal safety. This isolation can also help minimize PC and power line noise injected into the EEG signal conditioner when the BAERCOM is used while connected to a PC. Note that, in order to maximize this isolation capability, please try to keep the USB cable away from the animal, other BAERCOM cables, and the BAERCOM unit itself.

However, as mentioned above, we still **recommend** that you always **disconnect** the BAERCOM from the PC computer (by disconnecting the USB cable from the USB connector on the top panel of the BAERCOM) before actually collecting BAER data traces from an animal. The gain of the EEG signal conditioner in the BAERCOM is very high, and power supplies (especially external supplies used with Notebook computers) can introduce a substantial amount of high frequency electrical interference, that can easily distort or mask the actual EEG/BAER signal that the BAERCOM is designed to measure.

Note that you can often test for this aspect. Disconnect the USB cable from the Baercom. Turn the Baercom on, and let it complete the usual start-up process. Set the Function control to View, and disconnect both the speaker and input lead from the Baercom (if they are connected). While in View, and with the input lead disconnected, the Baercom should continuously plot a basically flat line with just a little ‘fuzz’ (noise) visible. Next, connect the Baercom to your PC (which should be on) with the USB cable. If you see more ‘fuzz’ with the USB connected, then noise from your PC is getting into the high gain amplifier in the Baercom, and you should probably do your Baer data collection with the USB disconnected.

2.2.4 LCD Display

The BAERCOM graphics LCD display is prominent in the top half of the front panel. The display shows the BAER trace both as it is being compiled and as a completed BAER trace. The characters posted in the upper right of the display indicate the ear tested as well as the number of scans (sets of 100 passes) the trace represents. The characters posted in the upper left of the display show what internal memory bin or “page” the data **will** be saved to, should you direct the BAERCOM to save the compiled BAER trace showing. Tick marks along the bottom of the display mark off one-millisecond intervals in the Baer trace.

2.3 Connecting the BAERCOM to your subject

In order to acquire good BAER data, you must carefully and conscientiously establish two good quality communications channels between the BAERCOM and the animal you are testing: one for the audio stimulus (supplied by the earphone), and one for the tiny EEG response sensed by the electrodes and connected to the BAERCOM EEG signal conditioner by the Input Assembly.

Note that the [a] placement and connection of the electrodes, the [b] setting of the Ear Select switch, and the [c] placement of the Earphone in the Ear Canal, MUST ALL AGREE in order to correctly sense the BAER signal for the specific ear being tested!!!

2.3.1 Earphone insertion

The BAERCOM delivers the audio stimulus to the animal's ear with a small earphone. Inserting the Earphone is easy:

1. Gently push the soft, clear plastic tip on the Earphone, deep into the ear you wish to test. Try to ***seal the ear canal as best as you can with the tip*** during actual BAER data collection, so the clicking sound does not leak out and cause the subject's other ear to respond. You may need to hold it in place.

2. Plug the Earphone lead connector into the matching three pin "**out"** jack on the left side of the bottom panel of the BAERCOM.

2.3.2 Electrode connection

Mastering the information and techniques in this section are a crucial part of the successful use of the BAERCOM, or any other BAER instrument!

The BAER response is generated by both the ear and the brain, and appears in the subject's EEG signal in the first approximately ten milliseconds after the click stimulus. The BAER response is *very* small, less than one microvolt, and so must be sampled repeatedly in order to build up a detectable response.

In addition, the BAERCOM's EEG signal conditioner is configured to **greatly amplify** this signal, and in the process, will also greatly amplify any **unwanted** electrical noise as well.

*The **ONLY WAY** to minimize unwanted electrical noise and interference is to use some type of "needle" electrode, placed "subcutaneously", i.e. under the skin, in direct contact with the "live tissue" underneath the skin.* **Failure to achieve a good quality sub-cutaneous "live tissue" connection for all 3 electrode connections can result in noisy or otherwise indistinct BAER data !!!**

Note that the skin of animals is substantially less sensitive than human skin, and so the use of needle electrodes is not as much of a "bother", so carefully make sure that each needle extends into the sub-cutaneous, live tissue. Even though light sedation may be required on some animals, careful and calming animal handling is usually sufficient to allow collection of the BAER data from most animals.

There are two common, readily available means to achieve the required sub-cutaneous connection. One approach is to use the small stainless steel needles used with hypodermic syringes. A simple "Alligator Clip" connector then makes the required electrical connection with the needle shaft. The other approach involves the use of actual "Needle Electrodes" specifically built for sub-cutaneous use. These electrodes already have an attached lead that takes care of the electrical connection. Either way works well, and the instructions below cover both

Note that the detailed connection instructions that follow cover two key aspects: the **quality** of the sub-cutaneous connection to "live tissue", as well as the correct **signal routing** required for correctly connecting electrodes to the proper inputs of the BAERCOM. **BOTH** aspects are crucial for the proper use of the BAERCOM!!!

Correct **signal routing** for the 3 BAERCOM input connections should begin with the three **safety jacks** on the Input Assembly molded block. The text labeling of the 3 jacks is both color-coded and descriptive to show where on the subject each of the electrodes should be connected.

- The top jack is marked **CROWN** (in ***black*** lettering, which corresponds to the ***black*** alligator clip) and should be connected to the electrode on the **TOP** of the animal's head.

- The middle jack is marked **LEFT** (in ***yeLlow*** lettering, which corresponds to the ***yeLlow*** alligator clip) and should be connected to the electrode next to the animal's **LEFT** ear.

- The bottom jack is marked **RIGHT** (with ***Red*** lettering, which corresponds to the ***Red*** alligator clip) and should be connected to the electrode next to the animal's **RIGHT** ear.

As indicated, the "Crown" electrode should be placed at the top of the animal's head. The two electrodes adjacent to the Ears should be placed where convenient directly below the Ear Canal, at approximately the level of the bottom of the flap of loose skin that is normally referred to as the "Ear", but fairly close to the ear canal. One of our colleagues, Dr. Collette Williams at U.C. Davis, recommends this placement for the two ear electrodes: "*I find the best place to put the ear electrodes is at the base of the ear just below the caudal attachment of the zygomatic arch. This structure is very easy to palpate and this placement gives you the best amplitudes on the earliest peaks.*" (And as pointed out previously, you need to decide what Right and Left actually means; front view or back view, just be consistent!)

As mentioned above, the BAERCOM Input Assembly can be used with the two most common types of needle electrodes:

- ***Disposable hypodermic needles (see Section 2.3.2.1)***

A set of 8-inch safety jack leads is provided with your BAERCOM. Each lead has a color-coded alligator clip on one end that clips securely to a standard *stainless steel* hypodermic needle placed on the subject. Hypodermic needles are very common, and most are disposable, so sterilization is not a concern.

- ***Reusable needle electrodes (see Section 2.3.2.2)***

Your BAERCOM comes with a set of three reusable needle electrode leads as well. The needle electrodes at the ends of these leads are a smaller gauge (diameter) than most hypodermic needles, so animals may tolerate them better. In addition, if you do a lot of BAER testing, the reusable electrodes may prove more cost effective than disposable hypodermic needles. However, reusable needle electrodes *must be sterilized* between each use.

As mentioned in Section 2.1.2, the reusable electrode lead colors **may or may *not* match** the colors shown on the molded jacks, so extra care is necessary to make sure the electrode leads are properly connected to the correct locations on the animal!

As already discussed, we have designed the BAERCOM with a 3 electrode connection in mind, in order to minimize the number of electrodes that need to be placed on the animal. This approach involves using the electrode for the ear *not* being tested as the reference for the EEG signal generated by the ear under test. The BAERCOM has a switch on the bottom panel (Ear Select switch) to correctly connect the electrode from the ear not being tested to the reference input of the amplifier.

Whichever electrode type is used, carefully follow the guidelines discussed below. ***This aspect of the BAERCOM connection process is very important!***

2.3.2.1 Disposable hypodermic needle use

Disposable stainless steel hypodermic needles are commonly available and have been found to work well with the BAERCOM. When BAER testing on a particular animal is finished, the needles can simply be removed and thrown away, and a new set used for the next subject. We recommend using these electrodes at first. Follow these steps to use disposable hypodermic needles as the electrodes for the BAERCOM.

1. Plug the three color-coded alligator clip leads – Black, Yellow and Red – into the correct jack on the Input Assembly molded block labeled with the matching color.

2. Gently "bunch" the animal's skin at the desired electrode site, then insert the first of the three needles subcutaneously through the skin fold so that 1/4" to 3/8" (6mm to 10mm) of the needle's length protrudes out the other side (Figure 3). **MAKE SURE** that the needle goes **BELOW** the skin tissue to allow the needle to contact the sub-cutaneous "live tissue" under the skin!

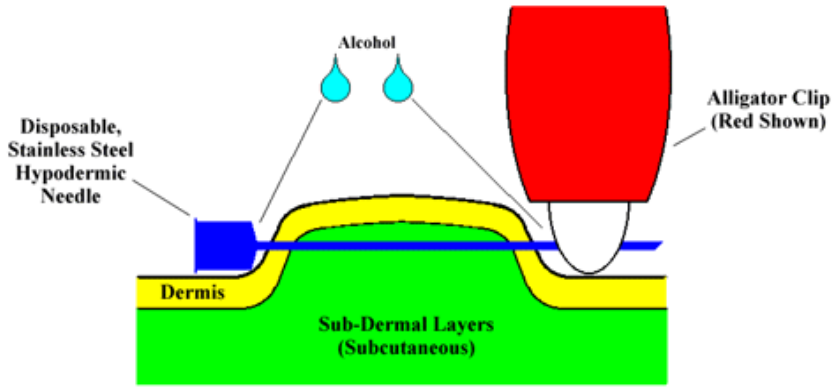


Figure 3. Electrode insertion using disposable hypodermic needle

3. Fasten the correct alligator clip over the exposed, *pointed* end of the needle. This approach provides a fairly secure mechanical attachment, as well as a good electrical connection. ***Be sure the alligator clip color corresponds to the correct electrode location on your animal.***

4. Place a couple drops of alcohol on the exposed ends of the needle, using a cotton ball, to improve signal quality and further disinfect the needle site.

5. Repeat Steps 2 through 4 for the other two electrodes.

2.3.2.2 Reusable needle electrode use

Your BAERCOM includes three reusable stainless steel needle electrodes on leads. Each electrode lead has a plug to allow insertion into one of the three jacks on the Input Assembly molded block. If you need to test a large number of subjects, reusable needle electrodes may be a more cost-effective approach than disposable hypodermic needles.

As opposed to the method using disposable electrodes, reusable electrodes offer *no mechanical means to hold the needles under the skin*. Animal motion can easily dislodge electrodes, so you may need to anchor the Input Assembly molded block to the animal to keep it from pulling the electrodes out.

For this reason, we recommend that at first, you use disposable hypodermic needles with the alligator clips. Once you have come up to speed with the use of the BAERCOM, you can then switch to Needle electrodes, and work through the issues they bring.

REUSABLE NEEDLE ELECTRODES MUST BE STERILIZED BETWEEN ANIMALS.

Follow these steps to place and connect reusable needle electrodes:

1. Gently "bunch" the animal's skin at the desired site, then insert the needle electrode subcutaneously into the skin fold. As opposed to the disposable needle method, ***do not push the needle out the other side of the bunched skin*** (Figure 4). However, you must still **MAKE SURE** that the needle goes **BELOW** the skin tissue to allow the needle to contact the sub-cutaneous "live tissue" under the skin!

[Illustration on next page]

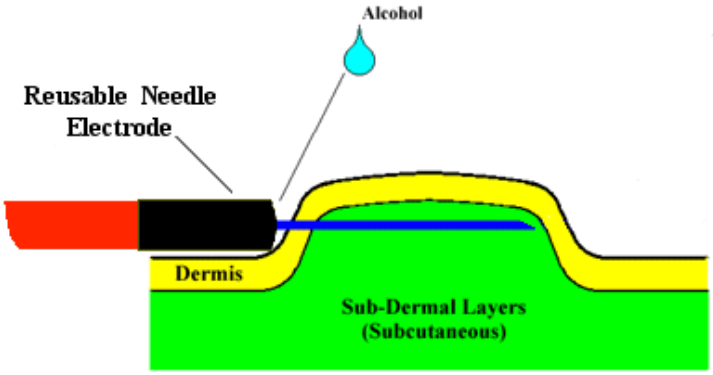


Figure 4. Electrode insertion using reusable needle electrode

2. Plug the electrode lead into the appropriate jack on the Input Assembly block.

MAKE SURE TO CORRELATE THE *LOCATION NAMES — "CROWN," "LEFT," AND "RIGHT" -- ON THE MOLDED INPUT ASSEMBLY LABEL*, WITH THE PROPER ANIMAL LOCATIONS. *REUSABLE ELECTRODE LEADS THEMSELVES MAY OR MAY* NOT *BE CORRECTLY COLOR-CODED.*

3. Place a couple drops of alcohol on the exposed portion of the electrode, using a cotton ball, to improve signal quality and further disinfect the needle site.

4. Repeat Steps 1 through 3 for each of the other electrodes.

Note that "Reusable" electrodes will not last indefinitely, but will need to be both carefully inspected, and if necessary replaced at regular intervals. Normal use will slowly erode the needle body, and repeated bending can weaken the needle causing breakage, so this should be avoided. Exercise care when using the thinner Needle electrodes, and inspect them frequently for signs of excessive wear or cracking, and replace them as required. You can purchase replacement needles from UFI, so contact us if you need more.

2.3.2.3 Connections and Actual BAER Testing

As mentioned, the BAERCOM incorporates a toggle type **Ear Select switch** on the right end of the bottom panel. This switch ensures that the electrode connections are routed correctly for the ear being tested. ***The Ear Select switch permits the three electrode leads to be connected to the animal just once, then left in place for the duration of BAER testing.***

In addition to correctly connecting the EEG electrodes on the animal to the correct EEG Inputs of the BAERCOM, the BAERCOM also reads the Ear Select switch setting so the BAERCOM can annotate both the saved BAER trace data, as well as any BAER traces sent to the PC, with the actual EAR being tested.

Also, note that before actually performing BAER testing as described below, you will need to connect the black 4 pin plug at the end of the Input Assembly lead, to the "**in**" connector on the right end of the BAERCOM bottom panel. This connects the electrodes on the animal to the EEG signal conditioner inside the BAERCOM.

The actual mechanics of performing the BAER test with the BAERCOM is discussed in more detail in section 2.4 below. However, as an introductory overview, the general procedure for performing a BAER test on both ears of an animal is shown below.

1. Attach your disposable (Section 2.3.2.1) or reusable (Section 2.3.2.2) electrodes to the subject using the connections/locations specified below and shown in Figure 5:

Disposable electrodes	Reusable electrodes	Electrode location
Black alligator clip	Lead from CROWN jack	Crown (top of head)
Red alligator clip	Lead from RIGHT jack	Below right ear
Yellow alligator clip	Lead from LEFT jack	Below left ear

Figure 5. Example electrode placement

2. Connect the black connector at the end of the Input Assembly lead to the "**in**" connector on the right side of the BAERCOM bottom panel.

3. Gently insert the earphone (Section 2.3.1) fully into the ***right ear (as shown above)***, ***then set the Ear Select Switch to the RIGHT position***. (The electrode below the left ear acts as a reference; the electrode below the right ear is the active one.)

4. Perform a BAER test on the animal's right ear as described below in Section 2.4. You can start by collecting 15 Scans, and have the Click stimulus size set to 70 dB.

5. Remove the earphone from the right ear, ***insert it into the left ear, then set the Ear Select switch to the LEFT position***. (The electrode below the left ear becomes the active one, while the electrode below the right ear becomes the reference.)

6. Perform a BAER test on the animal's left ear, again using the same number of Scans and the same Click Stimulus size.

Note that you can easily test and re-test either ear during this process as you wish. In fact, if you have any questions about the results you get, you SHOULD repeat the test! If what you are seeing is the BAER signal, the results of successive tests on the same ear should look almost IDENTICAL!

Also, when you are done testing, you should gently and carefully remove the earphone and electrodes from the animal.

2.3.3 Animal tolerance: some suggestions

We have found that most animals easily tolerate the BAERCOM electrodes and wires. Animal age and past experiences help determine how well the procedure is tolerated. Careful and sensitive handling during BAER testing usually helps calm the animal. However, you may encounter animals that require mild sedation during BAER testing.

2.4 Using the BAERCOM to perform BAER testing

Simplicity of use has been an important design goal for the BAERCOM system since its inception. Actual BAERCOM operation can be broken down into the following three main tasks:

- ***Collecting and compiling a BAER data trace***

This important procedure covers the basic BAER data collection and plotting process to generate a Baer trace. The steps included in Section 2.4.1 show this most basic use of the BAERCOM.

- ***Saving, reviewing and deleting compiled BAER data traces***

Up to 31 compiled BAER data traces can be stored in bins or "pages" in non-volatile memory *inside* the BAERCOM for review whenever desired. See Section 2.4.2 for more information about saving, reviewing and deleting BAER data traces.

- ***Sending compiled BAER data traces to a computer***

After the BAERCOM has been used to collect a BAER data trace, the SHOW function is used to display the resulting BAER data trace on the Baercom LCD. A previously recorded BAER data trace can also be posted in the REVIEW position as well. After the data is displayed, the BAERCOM may be connected to a PC and the BAERCOM-PC software used for data download. And after downloading, you can generate a hearing report (both ears), then print, save, or review the BAER data traces as desired. Sections 2.4.3 and especially Section 4 discuss the use of the software.

2.4.1 Collecting and compiling a BAER data trace

After correctly connecting the BAERCOM to an animal (as described in section 2.3 above), there are three basic steps involved in using the BAERCOM to collect a BAER trace. These three steps correspond to the three major *FUNCTIONS* of the BAERCOM, which in turn map to BAERCOM Function Switch settings.

- ***VIEWing*** the EEG signal to check the electrode-animal connection
- ***COLLECTing*** the BAER data through a series of scans
- ***SHOWing*** the compiled BAER response (trace)

If your goal is to actually collect BAER data from an animal at this point, be sure that your BAERCOM is *already* properly connected to an animal as described above.

2.4.1.1 VIEW the EEG signal (and Baercom power-up)

The VIEW function is provided to allow a basic check of the animal connections and EEG signal path prior to collecting BAER data. Since the VIEW process is likely the first function you will select, this discussion includes the actual "power on" process for the BAERCOM as well.

1. Set the switches on the BAERCOM as follows before turning on the power:
   - Set the **Function Switch**, below the lower left corner of the display, to the VIEW position;
   - Set the **Resolution/Control Switch**, below the lower right corner of the display, to MEDIUM;
   - Set the **Click Stimulus Size Switch,** below the **Function Switch**, to 70 dB;
   - Set the **Ear Select Switch** at the right end of the bottom panel as follows: set to LEFT to check the left ear, and to RIGHT to check the right ear;

2. ***Now*** power up the BAERCOM by pulling the **Power Switch** handle out to unlock it, then up to the ON position. The following screens appear on the BAERCOM LCD display in sequence, as the BAERCOM boots up:

Startup screen 1

Startup screen 2

Startup screen 3

Startup screen 4

(Note that the current Baercom Firmware is v D.2, NOT D.1!)

3. The BAERCOM will now start to plot the EEG signal it is receiving from the animal through the electrodes and Input Assembly. At this point there is no audio stimulus, and the "raw" EEG signal display should resemble Figure 8: a nearly flat line in the center of the display with some noise visible. If the EEG plot looks extremely noisy (large peaks), or has an erratic baseline, recheck all electrodes and connections between the BAERCOM and the animal.

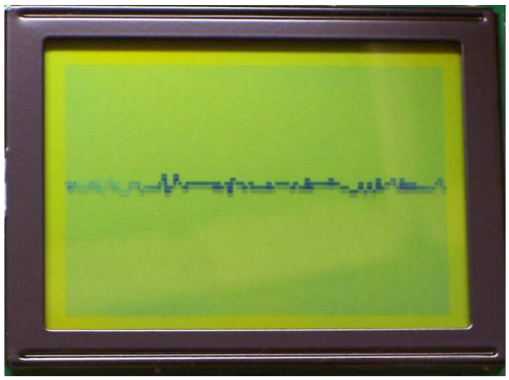


Figure 8. EEG signal while VIEWING

By the way, at this point you may want to check the position of both the Ear Select switch and which ear has the Earphone inserted, just to make sure everything is set up correctly.

Also, note that you can turn the BAERCOM power on with the Function switch set to any position. However, the BAERCOM will post a message prompting you to set the Function switch to VIEW, and will ignore any other switch settings until this is done. This behavior only happens when the BAERCOM is first turned on. You can also turn the BAERCOM function switch to the VIEW position at any point to again re-check the signal, which will interrupt any operation currently in process.

2.4.1.2 COLLECT the BAER data trace

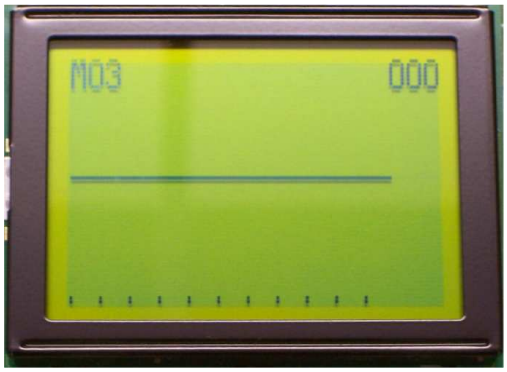
Next, set the Function switch to “COLLECT”. The BAERCOM will begin generating the audio stimulus (a staccato clicking sound from the earphone), and then gathering the EEG signal, from the electrodes on the animal. Beginning with the click onset and lasting for the next 11 milliseconds – one Baer data collection **pass** -- the BAERCOM records the subject’s EEG response to the Click stimulus. The BAERCOM repeats this stimulus-response cycle 100 times, for one complete **Scan**.

After each approximately three second Scan (100 passes), the BAERCOM stops collecting the response data long enough to sum all EEG data collected so far, and generate the summed Baer trace on the display. This plot averages together the ***cumulative BAER data for all Scans since the Function Switch was last turned to the COLLECT position.***

Follow this procedure to collect your BAER data:

1. Leave the switches where they were for the VIEW function (Section 2.4.1.1).

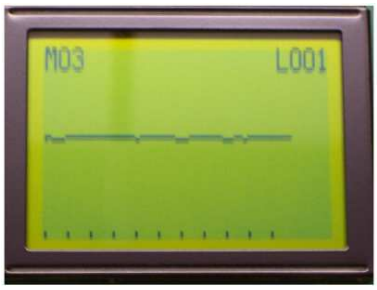
2. Turn the **Function Switch** to the COLLECT position. (This may be done not only from VIEW, but from the other switch positions as well.) You will initially see a display similar to this one.



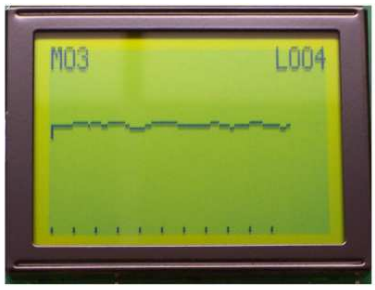
The "M03" in the upper left corner indicates that BAERCOM internal memory Page 3 is the **first one available** for BAER data trace storage out of the total of 31 writable pages; traces are always saved in the first available page. (Page 32 is reserved for sample data from an actual BAER test on a canine subject.) If you decide to save the data trace now being collected (as described in section 2.4.2), it will be stored in Page 3. The "000" in the display's upper right corner indicates that no Scans have been completed yet.

You may hear the clicking sound of the audio stimulus coming faintly from the earphone. If the clicks are loud, check to be sure the earphone is snugly inserted in the animal's ear canal, and re-start the testing (View then Collect again). Note that the animal's other ear can respond to the Click as well if it is not very quiet.

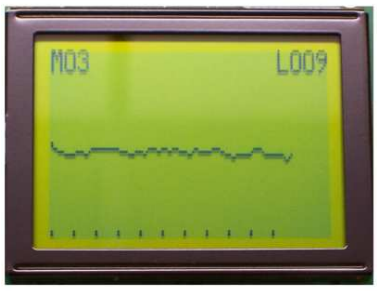
3. As the first Scan of 100 passes is completed, the BAER data from the first Scan will appear on the display (top left image below, where we are assuming that the **Ear Select** switch is set to LEFT). As you continue data collection, you'll see the display evolve as further Scan data are averaged in with the data of the previous display.



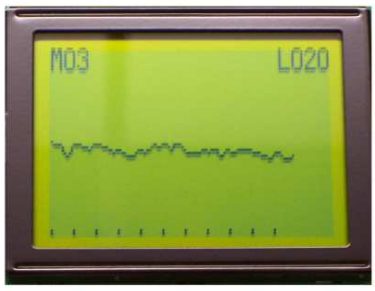
After one scan



After four scans



After nine scans

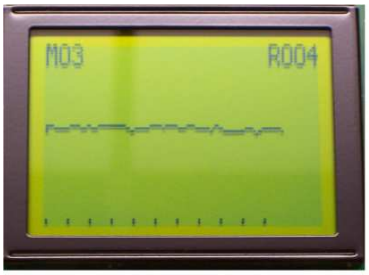


After twenty scans

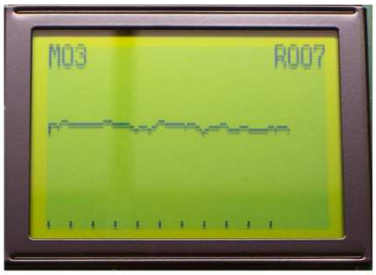
(Note that there is no animal connected for these samples, we are focusing mainly on the mechanics and activities of the BAERCOM during normal use.)

The BAERCOM continues scanning as long as the Function Switch remains set to COLLECT. The upper limit is 999 scans, or 99,900 total passes. Despite this high capacity, ***you can usually discern a BAER response after just 10 to 20 Scans*** for small animals.

4. If you had set the **Ear Select Switch** to the RIGHT position rather than to LEFT, you would see a similar evolution of the BAER test data, except that an "R" precedes the three digits showing the number of Scans in the upper right corner, indicating the Right ear is currently being tested.



After four scans



After seven scans

Note that you should **not** change the position of the Ear Select switch while the function switch is in the "Collect" position. If you realize the switch is set incorrectly, or the Earphone is placed incorrectly, simply turn the function switch back to the "View" setting, correct the Ear Select switch setting or Earphone placement, check the resulting VIEW signal, then move the function switch back to "Collect" and start BAER data collection again. (The BAERCOM will allow you to change the Ear Select switch as desired during Collect, but this will just add incorrect data to the overall summed BAER plot, which makes it **invalid**, and so should be avoided.)

If, in Step 2 above, "M32" (M24 on older Baercoms) is displayed in the upper left corner, *all writable BAER memory pages inside the BAERCOM are being used.* ***While Page 32 is displayed, BAER data cannot be saved to BAERCOM memory*** (Section 2.4.2 below). Sample BAER data stored in Page 32 *cannot* be erased.

The whole goal of the "Collect" process is to collect BAER data until an easily discernible BAER signal (trace) is posted on the BAERCOM LCD display. Assuming that the subject connection is good, and the animal can hear, this should happen after between 10 and 20 Scans for small animals.

2.4.1.3 SHOW the BAER data

Turning the Function Switch to the SHOW position halts both the audio stimulus and BAER data collection, immediately stopping the Scan that may be in process. The display now simply plots the BAER data 'trace', averaged from all the complete Scans compiled together up to this point, for your examination, for saving, or for transmission to your PC running the BAERCOM-PC software.

Using SHOW is very simple:

1. Move the **Function Switch** from the COLLECT to the SHOW position when you can clearly discern the BAER response. As already mentioned, this usually takes 10 to 20 scans for small animals. (Use the same number of scans for both ears!) You should already know what you are looking for; the typical BAER response. The shape of the BAER signal has been discussed in Section 1. In addition, an actual small animal BAER sample tracing is shown in the BAER data in "Page 32" permanently saved in the BAERCOM memory.

2. Earphone clicking stops as soon as the **Function Switch** is turned to SHOW, and the display freezes to show the last summed BAER data trace. The characters in the upper right corner of the display indicate the **Ear Select** switch setting – L for left or R for right – and the total number of Scans made.

3. In the upper left corner of the display, the characters "M##" begin blinking about once a second, and show what memory page will be used to store the BAER data trace, if you go on to use the SAVE function (Section 2.4.2).

4. Finally, the BAERCOM USB port begins sending the displayed BAER data trace to your PC if you have connected the USB cable. The **Ear Select** switch position and number of Scans for the trace are sent to the PC along with the BAER data trace shown on the display. Note that if you don't want or need a printed record of the test, or to save it on your computer, there is no need to connect the BAERCOM to your PC.

2.4.1.4 Comments about BAER data trace collection

The VIEW-COLLECT-SHOW steps encompass the overall BAER data trace collection process that is at the heart of the functionality that the BAERCOM supplies. This process is typically performed twice, once for the LEFT ear and once for the RIGHT ear, and these two BAER tracings together supply an overall understanding of the animal's hearing ability at the time of the testing.

a. We indicate that it generally takes between 10 and 20 Scans to collect an easily discernible BAER trace from small animals. Your experience with the use of the BAERCOM will give you a better handle on exactly what to expect in this area, across the breeds and animal ages involved in your practice.

b. As mentioned, you should attempt to use the **SAME** number of Scans and click stimulus size for **BOTH** Left and Right ears as you test each animal. This will make it easier to highlight any hearing abnormalities that you may encounter.

c. The BAER signal, and the testing used to display it – is a **REPEATABLE PROCESS**. If, on the one hand, you are unsure of your results, DO NOT HESITATE to repeat the COLLECT-SHOW process. Feel free to check electrodes, leads, and Earphone, then perform the BAER signal collection again, maybe for more Scans than before. On the other hand, if the final plot is substantially different each time you collect BAER data on the same ear, and for the same number of Scans, then it is not the BAER signal you are seeing. You are probably seeing noise, which usually points to problems with the electrodes not all actually making contact with subcutaneous "live tissue".

We recommend "coming up to speed" with the BAERCOM by working calmly and patiently with one or more "known hearing" animal(s) first. This approach will help you develop the instrumenting skills necessary to acquire good quality BAER data with the BAERCOM, in a more relaxed "trial and error" manner, before actually testing other animals. The first time you encounter a "Uni" or an animal that supplies non-hearing indication, it is this previous experience and understanding that will help you discern the difference between hearing abnormalities and some sort of setup or connection problem.

Also, if you use the BAERCOM infrequently, we recommend the same "hands on" testing on a known good animal ahead of actually testing animals, as a refresher course in the mechanics of using the BAERCOM.

2.4.2 Saving Reviewing and Deleting BAER data traces

Up to 31 (23 for older Baercoms) BAER data traces can be stored permanently in bins or "Pages" in the BAERCOM internal memory. The following sections describe how to manage saved BAER data traces in the BAERCOM.

- SAVE (2.4.2.1) collected data traces in the BAERCOM
- REVIEW (2.4.2.2) recorded data traces with the BAERCOM
- DELETE (2.4.2.3) recorded data traces from the BAERCOM
- DELETING ALL TRACES AT ONCE (2.4.2.4) ***New!***

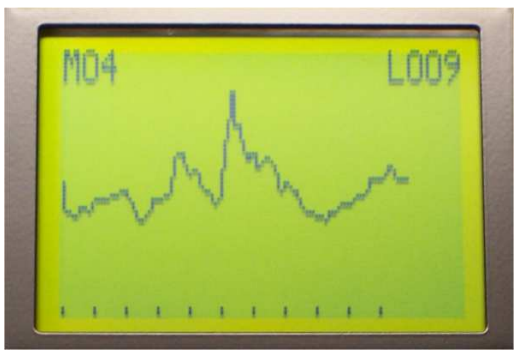
2.4.2.1 Saving BAER data traces in the BAERCOM

As we've noted before, the SAVE function allows you to store up to 31 BAER data traces to internal BAERCOM memory (23 traces for older Baercoms), one such trace to each of the 31 memory "pages". ***Each page holds the compiled BAER trace for <u>one</u> ear (not both).*** Here's how to perform the SAVE function:

1. Let's assume that you have just used the COLLECT function to compile a BAER trace, and then moved the Function switch to the SHOW position. Start the Saving process by moving the **Function Switch** from SHOW to SAVE (one position to the Right), and the following appears on the display:

2. Turn the **R/C Switch** to MEDIUM if it is not set there already. Then turn the **R/C Switch** two positions clockwise to the NEXT position then back to MEDIUM, in the time it takes to say "click, click". This action tells the Baercom to save the trace showing.

3. The display changes to one similar to the following, where "M04" indicates that the trace – nine scans averaged together with the **Ear Select** switch at LEFT **–** has been stored to Page 4 (again this is not animal test data).



4. Turning the **R/C Switch** back to the MEDIUM position (if not already done) confirms the save. ***The SAVE function is now disabled until you collect new BAER data.*** Finally, move the **Function Switch** back to SHOW to finish the sequence.

5. If, after Step 3, you decide you ***do not want to save*** the displayed BAER data, just move the **Function Switch** away from SAVE to another position.

6. If ***while trying to save data*** you see a display with "M32" posted at upper left (M24 for older Baercoms like Figure 9), then ***no more writable BAER trace memory pages are available***.

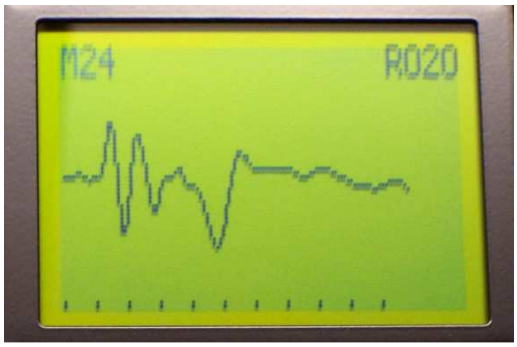


Figure 9. Sample BAER data from normal canine subject

You can save no more BAER data traces in BAERCOM memory at this point; the SAVE function is disabled. You will need to DELETE (Section 2.4.2.3) at least one saved BAER data trace before you can again save compiled BAER data to BAERCOM memory. (However, you need not discard the data plotted on the display if you have a PC with BAERCOM-PC installed. Just move the BAERCOM **Function Switch** to SHOW, hook up the USB cable from the BAERCOM to your PC, and then download the data to it. This is described in Section 4.4).

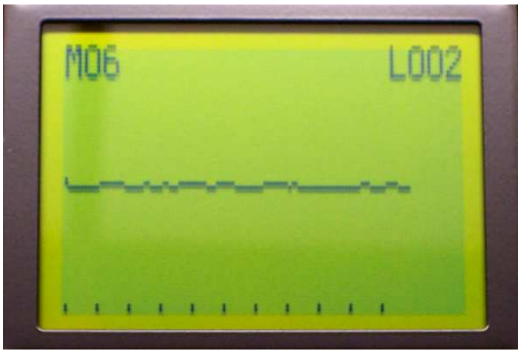
Note that saving BAER data traces in the BAERCOM internal BAER data memory requires that you carefully document which saved data traces and "pages" go with which animal!!! The saved data will include the Ear Select switch setting, but your records need to connect saved data pages with the animals the BAER data traces were taken on!!!

2.4.2.2 Reviewing data traces saved in the BAERCOM

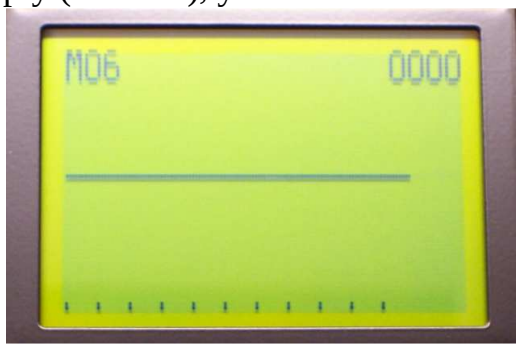
The REVIEW function lets you find and display both the BAER data traces that you have stored in BAERCOM internal memory, as well as the sample data trace permanently saved in Page 32. ***Unless you use REVIEW, any data displayed is always data you've just collected***. Here's how to display a stored BAER data trace.

1. ***Be sure the display does not show any unsaved data that you want to save!*** If it does, follow the steps in Section 2.4.2.1 to store this trace in a memory page before you proceed with REVIEW.

2. Set the **R/C Switch** to LOW, MEDIUM or HIGH. Then turn the **Function Switch** to the REVIEW position. The contents of the current memory 'page' are displayed. If , for example, you have just saved a BAER data trace to Page 6, a test consisting of two scans with the **Ear Select Switch** at LEFT, when you select Review, your display would look like this:



If Page 6 is still empty (no trace), you will see this "flat-line" display instead:



3. To display the contents of the ***next page*** – an empty Page 7 in this example – turn the **R/C Switch** to NEXT until you see the next data trace plotted, then turn it back to LOW, MEDIUM or HIGH.

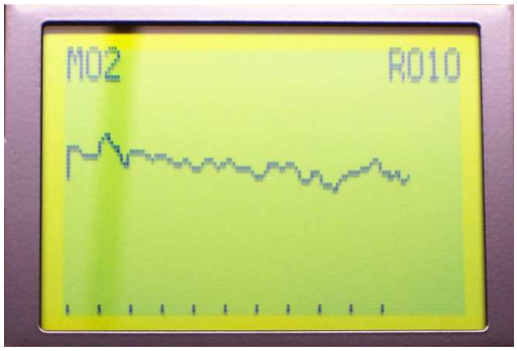
4. To find and plot a BAER data trace in a ***higher-numbered page***, simply turn the **R/C Switch** to NEXT ***and let it remain there until the page / data trace you want is displayed***. While in NEXT, the Baercom plots successive traces continuously, holding each one for about 2 seconds. As soon as you see the desired trace, turn the **R/C Switch** back to LOW, MEDIUM or HIGH to stop the forward progression through the memory pages. (If you keep the switch set to NEXT, the display continuously cycles through all 32 traces / pages (24 on older Baercoms), then starts over at page 1, 'M01'.)

5. To ***download any memory page trace*** to the software (more in Section 4.4), wait until it is showing, then turn the **R/C Switch** to MEDIUM if it is not already there, then turn the **Function Switch** to SHOW. The BAERCOM sends the selected, displayed trace through its **USB port** to a connected PC running the BAERCOM-PC software.

2.4.2.3 Deleting data traces from the BAERCOM

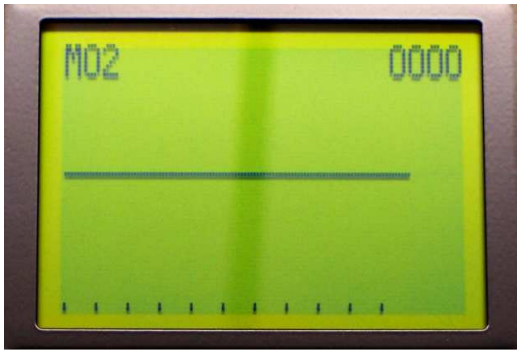
The DELETE function allows you to remove BAER data traces from BAERCOM internal memory, one trace, one page at a time. Here's how to do it.

1. Find the BAER data trace / page you want to delete and post it to the display using the REVIEW function as explained above. Basically, you set the **Function** switch to REVIEW, then set the **R/C switch** to NEXT until the trace / page you wish to erase is showing, then move the **R/C switch** back to MEDIUM. If you want to ***delete a series of traces (pages), start by displaying the one in the lowest-numbered page*** to minimize the time required to delete the whole series. As an example, we'll delete the contents of Page 2, displayed on the next page.



2. *With the **Function Switch** still at REVIEW*, turn the **R/C Switch** counter-clockwise to DELETE. The following screen is displayed:

3. ***To make the deletion (make sure first!)***, turn the **R/C Switch** from MEDIUM to NEXT then back to MEDIUM, in roughly the time it takes to say "click, click". (Turn the **FUNCTION** switch away from REVIEW to ABORT the erase.) After erasing, this screen confirms that Page 2 is empty:



4. ***If this is the only BAER data trace you want to delete at this time*** – Page 2 in our example -- turn the **R/C Switch** back to MEDIUM the moment the delete is confirmed with the above display.

5. ***If you want to make further deletions***, however, move the **R/C Switch** to NEXT until the next desired plot appears on the display. Then turn the **R/C Switch** quickly back to MEDIUM to stop the display from cycling through consecutive memory pages. Finally, turn the switch to DELETE to begin the sequence of Steps 2 through 4 or 5 as described above. ***Repeat the sequence until you have cleared all desired memory pages, one at a time.***

6. ***If, after Step 2, you decide that you do not want to delete the BAER data set after all***, just move the **Function Switch** away from the REVIEW position, then turn the **R/C Switch** away from DELETE. The BAERCOM memory contents remain unchanged.

2.4.2.4 Deleting ALL data traces from the BAERCOM (vD.2)

Erasing all 23 traces / memory pages from a Baercom is a tedius, error prone job. We understand; we had to do this to each Baercom during our testing. And now, there is room for 31 traces / pages! When we did the coding for the vD.2 Baercom Firmware, we tried to give everybody a break! **We added the ability to ERASE ALL Baercom Traces / Memory Pages, ALL AT ONCE!** This new feature can save a LOT of time and frustration. But we 'just know' that we will get a phone call from someone who accidentally just erased *two days worth* of Baer testing results, asking us if there is anything we can do about it. The answer is 'no'. This process does not overwrite the data, it completely erases it! Like we say repeatedly in the release notes for the vD.2 Firmware –

USE THIS 'ERASE ALL' ABILITY CAREFULLY !!!

We disabled trace erasing for trace / memory page 24, for all earlier Baercoms. This page is sample data, and you can't erase it. And, after expanding the trace data memory pages to 31 pages, the Sample Data is now in page 32. Starting with firmware v D.2, **if you try to delete** the sample Baer data in page 32, the vD.2 Baercom assumes you want to **ERASE EVERYTHING**. This is how it works.

1. First, please **MAKE SURE** you **DO NOT WANT ANY** traces currently stored in the Baercom!!! Can we say check again? They will all be gone!

2. Use the Review function to show the Sample Data trace in memory Page 32. Basically, you set the **Function** switch to REVIEW, then set the **R/C switch** to NEXT until the page 32 (Sample Data trace) is showing, then move the **R/C switch** back to MEDIUM.

3. **IF YOU ARE SURE** you want to continue, move the **R/C Switch** to DELETE. Now, relax a little while; the Baercom flashes a series of 4 messages, asking you **IF YOU ARE SURE** you want to erase **EVERYTHING**! **MAKE SURE**, because it **WILL ALL BE GONE!!! You can't complete the Erase All until these messages stop flashing! Take that time to MAKE SURE !!!**

4. If you realize you are **not ready yet**, turn the Function switch AWAY from the REVIEW position to abort, to exit the full erase process.

5. If you **DO** want to **ERASE EVERYTHING**, acknowledge this the same way you would for a page erase; move the **R/C Switch** from MEDIUM to NEXT, then back to MEDIUM, in the time it takes to say "click, click". The Baercom will post two messages as it re-initializes (clears) the entire memory array. The Baercom will then start operation **as if** power was just turned on. After the four start-up screens are done, the Baercom can be used as desired. At this point, all memory pages will be empty.

Well, if you are tired, or brain-dead, this can get you into a LOT of trouble. The rest of the time, it can save you a lot of hassle and frustration! Did we say enough **BE CAREFUL WITH THIS?!?**

2.4.3 Sending BAER data plots to a computer

You can use the BAERCOM-PC software to download BAER data traces from the BAERCOM to your PC computer. You can then perform a full suite of software functions with your BAER traces, focusing on pairing two or four ear Baer traces together into a report, then annotating your report, printing them out, and saving them to a hard disk drive or other memory device.

Section 3 of this manual takes you through the software installation process; Section 4 shows you how to use the BAERCOM-PC software features. Refer there for more details about the use of the BAERCOM-PC software.

2.4.4 Tips and tricks for using the BAERCOM

While we have sought to make the BAERCOM as easy to use as possible, the successful acquisition of the BAER signal requires the development of new skills and practices. The suggestions below can help ease the "learning curve" required for this process.

2.4.4.1 Making the learning curve a little easier

Please do *not* try to learn how to operate the BAERCOM in a pressured situation, with a paying client for example. Taking time out to practice with the BAERCOM in relaxed circumstances will pay for itself many times over, and maybe even help lower your blood pressure!

We recommend that you ***take your time*** in acquainting yourself with the functioning and use of the BAERCOM system:

- Start with a well-mannered young animal with *known good* hearing, then work through this manual in a relaxed way.
- Carefully connect the electrodes, then collect several BAER data traces.
- Experiment with the various controls; practice saving and deleting data traces.
- Compile different numbers of scans into separate traces to see what effect this has on trace appearance.
- You can also try different electrode locations to see how this changes the traces.
- Practice switching data collection back and forth between the two ears.
- Exercise the BAERCOM-PC software functions to become quick and adept.
- If using the BAERCOM is your first experience with BAER testing, we recommend that you find a "mentor" who is familiar with the process, if possible. Help from someone who has more experience will go a long way toward bringing you up to speed.

2.4.4.2 Suggestion for reviewing BAER results

As a BAERCOM novice, it might be best to collect and save two traces for each ear, making the same number of scans for each trace. Set the Stimulus Size to "0" – ***no*** click stimulus -- for the first plot. Set the Stimulus Size to maybe 70 dB – clicks that ***should*** be audible to your subject – for the second plot.

Now ***compare the two plots*** (for each ear) to identify the presence or absence of a normal BAER response for that ear. With a little experience, you will soon become familiar with the series of successive peaks that form a normal BAER response.

And do not hesitate to repeat a BAER Collection, if the first result seems ambiguous! If what you are seeing is the BAER response, repeating the data collection should result in an almost identical trace!

2.4.4.3 Adjusting BAER display resolution

You can adjust the BAERCOM to display your traces at three different vertical scales to accommodate greater or lesser spread in the data. The MEDIUM setting is most often best; when the traces are very noisy, or the BAER signal is unusually strong, you may have to switch to the LOW setting; when the trace shows very little shape at all, the HIGH setting will help you better see features that are present (although in this case taking more Scans is a better solution).

Switching among the three resolutions ***will not disturb the actual data*** stored inside the BAERCOM – only the data *display* is changed. Here's how to change the resolution.

1. Turn the **Function Switch** to SHOW to enable resolution changes. (The display resolution cannot be changed at other switch settings.)

2. Then set the **R/C Switch** to LOW, MEDIUM or HIGH to provide the best data trace display. Here's how the display of one BAER data trace, in this case the sample test in Page 24 (older Baercom), varies with the resolution setting.

LOW

MEDIUM

HIGH

The HIGH setting shows the most detail. Setting the **R/C Switch** to MEDIUM, or especially HIGH, may also "clip off" the top or bottom of the BAER data so that it cannot be viewed completely on the display. Should this occur, set the switch to MEDIUM or LOW, and you may need to do this as more scans accumulate in the plot. MEDIUM resolution usually works well up to 20 to 50 scans.

2.4.4.4 Some Troubleshooting suggestions

While we have sought to make the BAERCOM system components as robust as possible, you probably will encounter problems over time as you use the BAERCOM. Rather than being surprised by them, you need to be alerted about how various problems will impact the use of the BAERCOM.

a. When you run into indistinct trace problems, your FIRST STEP should ALWAYS be to **REPEAT THE COLLECTION!** As has been mentioned, if it is BAER signals you are seeing, or a lack there-of, successive Collections will look the same!

b. Next up, carefully check the routing of the electrode leads, then the placement of the Earphone (which ear) followed by the setting of the Ear Select switch. Setup errors like this are very easy to make!

c. Note also that if you can hear the “Click” more than very faint, then the animal’s other ear probably can hear it as well. You will need to gently re-insert the Earphone so that the stimulus remains confined to the ear under test.

d. Failure to achieve a sub-cutaneous (live tissue) connection for all 3 EEG electrodes is the primary cause of indistinct BAER data from any BAER instrument. If you are seeing noisy or non-repeatable data traces, you should carefully check the electrodes, and re-insert as necessary to make sure you have a sub-cutaneous connection. As mentioned above, animal’s skin is usually less sensitive, and most animals should tolerate this fairly well. And by the way, if the compiled data traces show a lot of noise, the data shown in the VIEW position will probably show a lot of noise as well. This can be your first indication that there is an electrode connection problem.

e. As mentioned above, the Click stimulus is responsible for the initiation of the BAER waveform in the animal's EEG signal. As a result, you can compare the BAER plot with the Click Amplitude set at (say) 70 dB, with the BAER plot with the Click Amplitude set at 0 dB, which is no click stimulus. (This test assumes same Ear Select switch setting and same number of Scans.) The difference between the two plots will be the contribution of the BAER signal to the animal's EEG signal.

f. Over time, and as the result of normal use, connection problems in the Input Assembly may surface. You can easily test the BAERCOM Input Assembly by inserting the Alligator Clip cables into the molded plastic header, and then clipping all 3 alligator clips to each other. Plug the black plug at the other end of the Input Assembly into the "**in**" connector on the lower right of the BAERCOM bottom panel as usual. Now, turn the BAERCOM on, and set the Function switch to VIEW. The BAERCOM will display the signal being sensed from the Input Assembly and should show a basically flat line with very little noise. You can now move the Input Assembly lead around, from one end to the other, and try the same with the Ear Select switch in either position. If for any positions, movements, or Ear Select switch setting you see a substantial amount of noise, there is a bad connection in the Input Assembly, and this should be repaired before any more BAER testing is performed. You may decide to do this simple test **as standard practice** at the **beginning** or **end** of any BAER testing. It may also prove helpful to have a "spare" Input Assembly on hand, since repair or replacement will take some time.

g. Should the Earphone stop supplying the clearly audible Click stimulus, or of the Earphone otherwise becomes physically damaged, you should contact UFI about repair or replacement.

Section 3: Installing the BAERCOM-PC Software

3.0 BAERCOM-PC Software Installation

The previous section (2) discusses the use of the Baercom to acquire BAER traces from your animals. The Baercom allows you to collect, view and review a single BAER trace, and also supplies internal storage for up to 31 traces. The BAERCOM-PC software was created to extend the capabilities of the Baercom system. This software can download BAER traces from the Baercom, and supplies the pairing of 2 or 4 BAER traces from 2 ears into a single animal format, and allows extensive annotations. The resulting single animal 'report' can be saved as a file, and printed out with several 'print-out' options. Clipboard functions are supplied as well. The actual use of the BAERCOM-PC software is covered in section 4 below.

However, before the BAERCOM-PC software can be used with the Baercom, this software must first be correctly installed on your computer. The installation process requires **both** the installation of the BAERCOM-PC program, as well as installation of USB drivers to allow the Baercom to communicate with your computer.

>If you have an earlier version of the Baercom-PC software already operating on your computer, you may be able follow a simpler upgrade path.

- If you are currently using v2.0 or v2.1, you can probably just copy the v2.2 program file into the same folder as your existing version, create a new Start Menu item, and be done. The v2.2 program file along with directions for this simple upgrade can be found in the new "v2.x Upgrade" folder on the CD.
- If you are currently using v1.x (1.5, 1.7, 1.9), you should perform the full install of the Baercom-PC software (section 3.3), and check to see if the USB drivers already in place will allow the software to communicate with the Baercom. If not, then install the USB drivers as well. (You may need to uninstall the old USB drivers first.)

>If you have not yet installed the Baercom-PC software on your computer, carefully follow all the installation instructions in this whole section! (Section 3)

3.1 System requirements

The BAERCOM-PC (v2.2) software program was written using VB.Net™ for use under Windows™ XP and newer operating systems. Aside from a free USB port, and whatever printer you might wish to use, the BAERCOM-PC software makes few demands of your computer. Most PC computers available today should work well.

3.2 BAERCOM-PC Software Installation Overview

As mentioned above, the overall installation of the BAERCOM-PC software includes two separate installation processes. The installation of the BAERCOM-PC program is discussed first in section 3.3 below. The installation of the USB drivers to allow the BAERCOM-PC software to access the BAERCOM unit over a USB connection is discussed in section 3.4 below.

Note that BOTH of these two installation processes MUST BE SUCCESSFULLY COMPLETED before you can access the BAERCOM unit with the BAERCOM-PC software !!!

3.3 Installing the BAERCOM-PC Program

The installation of the BAERCOM-PC software on the hard drive of your computer essentially involves copying the BAERCOM-PC software 'Program' (now Baercom22.exe) and any other necessary files from the software CD to a folder on your computer hard drive. In addition, this installation process should create a Start Menu shortcut for the BAERCOM-PC software to make it easier for you to start the program.

Installation instructions for the BAERCOM-PC software are included below for some versions of the operating system. While the particulars vary slightly, overall the process is similar for other versions. Also, screen-shots below are for the v2.1 installation; v2.2 is the same, after replacing 2.1 with 2.2.

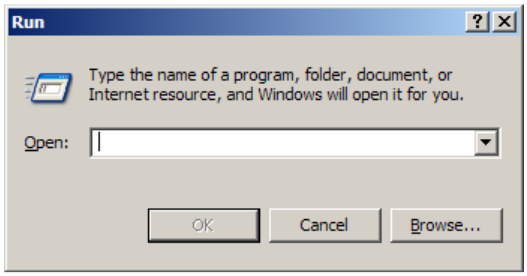
The basic approach is to insert the Baercom-PC software CD into your CD drive, and 'run' the Setup.exe program, which handles the installation. Accepting the default options selected makes this process pretty simple. The rather verbose instructions below can help less experienced computer users.

3.3.1 Installing on Windows™ XP

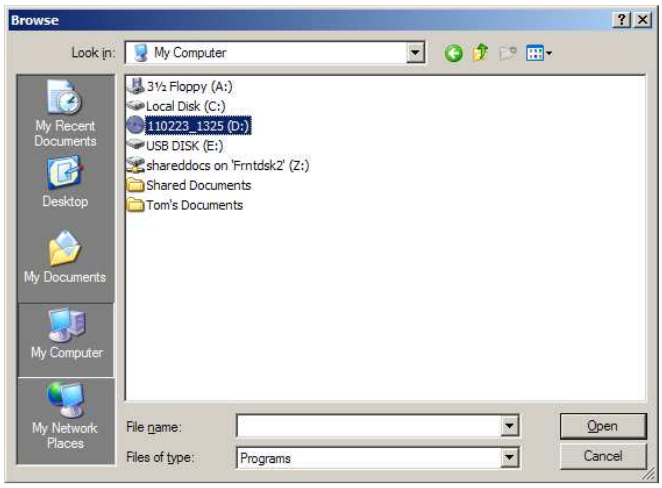
Follow the step-by-step instructions below to install the BAERCOM-PC v2.2 software to your Windows™ XP computer.

1. We recommend that you shut down any unnecessary applications during the installation process.

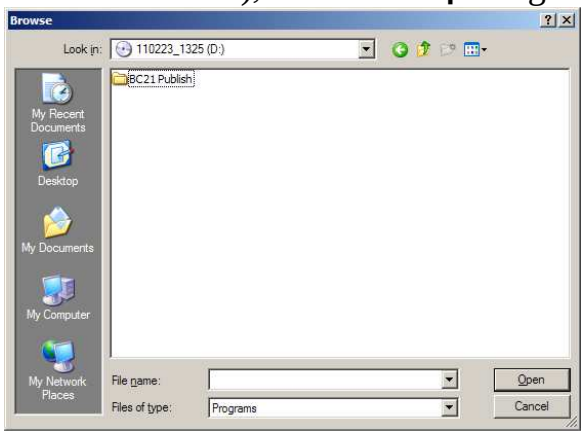
2. Insert the BAERCOM Software CD (v 2.2) into the CD drive on your computer. Click on the Start menu, then click select **Run…**. The "Run" dialog box opens; click the **Browse…** button:



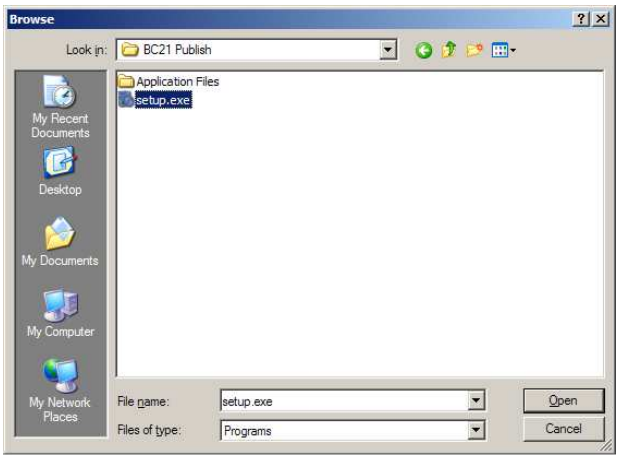
3. In the "Browse" window that appears next, choose **My Computer** and then select your CD drive, very often labeled "(D:)" , then click **Open**:



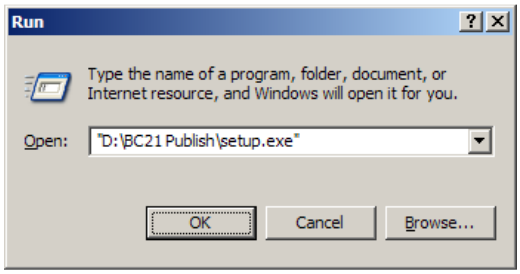
4. In the next "Browse" window, choose the **BC22 Publish** folder (even though BC21 is shown in the screen-shot), then click **Open** again:



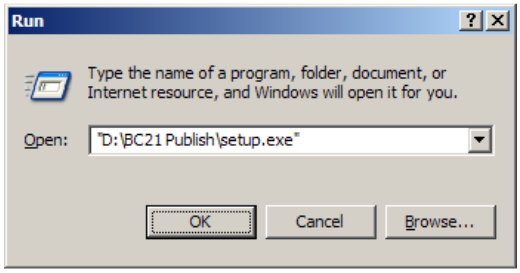
5. In the following "Browse" box, select **setup.exe**, then click **Open** once more:



6. The "Browse" window disappears; the "Run" window should now be filled in. The setup.exe program copies the program files included in the install package on the CD to your computer and places them where they belong. And remember, your installation will show "…BC22…" for the v 2.2 software.

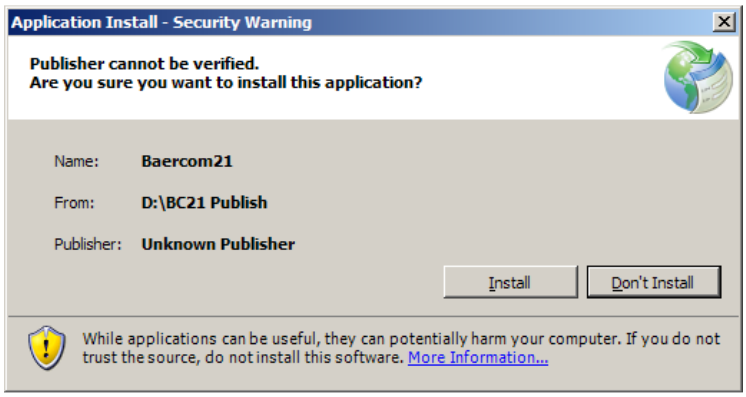


7. The "Browse" window disappears, and the "Run" window should now be filled in. Click **OK**:

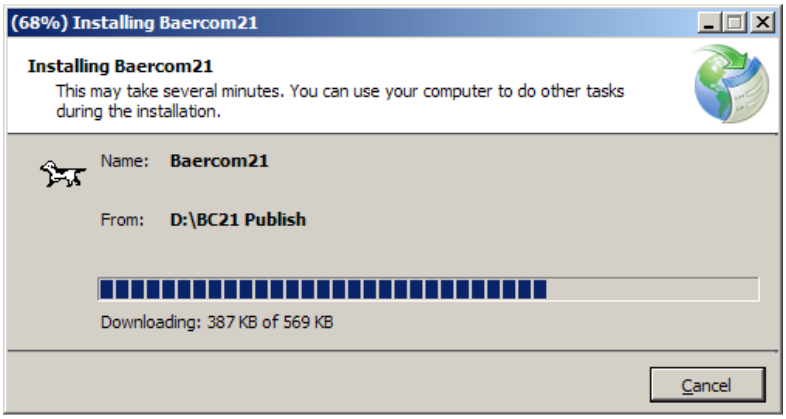


8. After a brief pause, you should see quick messages similar to the following:

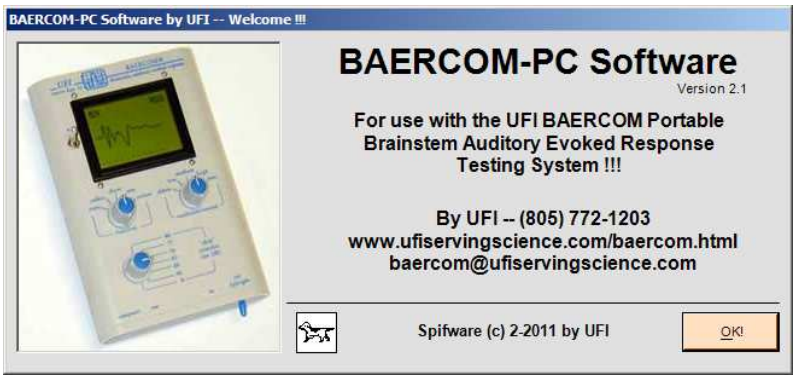
9. If you see this message, go ahead and click **Install** (the "publisher" is UFI):



10. An install progress window like the following now appears. Despite the caution about "several minutes" for installation, it should take only about 5-15 seconds if your computer is a reasonably fast one, since the BAERCOM-PC software is not a large application:



11. If all goes well, the next thing you'll see is the BAERCOM-PC software **welcome window (again, for version 2.2 instead)**, which is your starting point for actually putting the software to work, which is described in Section 4:



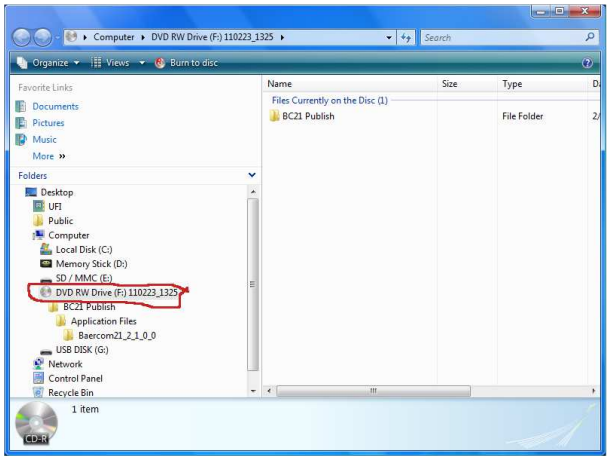
12. If the install fails for any reason, note what any error messages say, then go back over the installation process described here to make sure you have not skipped any steps. Also make sure you have installed all the current Windows Updates for your operating system. If you still have issues, contact UFI for support.

3.3.2 Installing on Windows™ Vista or newer

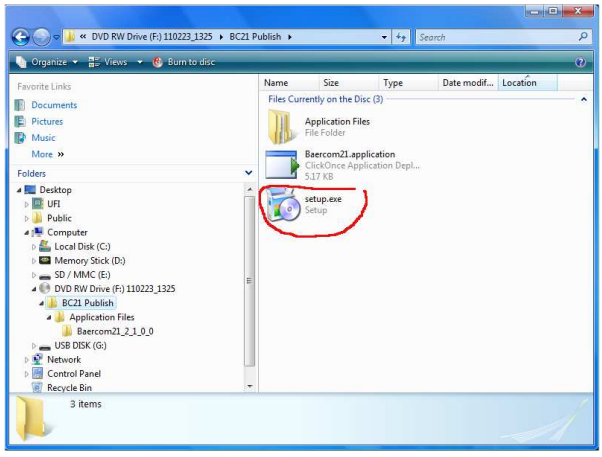
Follow the step-by-step instructions below to install the BAERCOM-PC v2.2 software to your Windows™ Vista computer. Windows™ 7, 8, and 10 (probably) will be similar. An again, the screen-shots show 2.1, but 2.2 is the same.

1. We recommend that you shut down any unnecessary applications during the installation process.

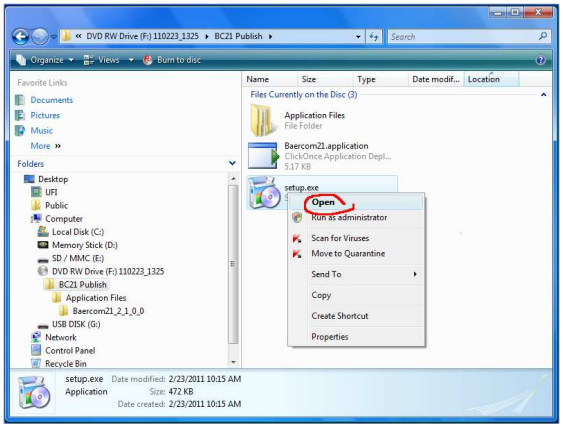
2. Insert the BAERCOM-PC disk into the CD or DVD drive on your computer. A window similar to the following should open automatically. Click on the icon for the media – in this case the CD drive -- that contains the "BC22 Publish folder." This folder holds all the installation files for the BAERCOM-PC software.



3. Now click on the “BC22 Publish” folder, opening it to show file “setup.exe:”

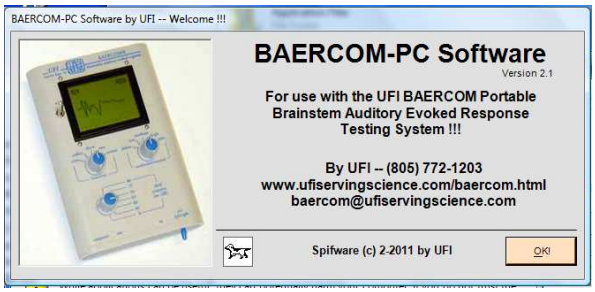


4. Right-click on **setup.exe**, then click **Open** in the drop-down menu:



5. After a brief pause and perhaps a couple quick messages, you may see this window. Go ahead and click **Install** (the "publisher" is UFI):

6. After another rapid message or two advises you on installation progress, the BAERCOM-PC software **welcome window** should appear (again, for 2.2, not 2.1). This is the starting point for actually putting the software to work, which is described in Section 4:



7. If the install fails for any reason, note any error messages, then go back over the installation process above to make sure you did not skip any steps. Also ensure that you have installed all current Windows Updates for your operating system. If you still have issues, contact UFI for support.

3.3.3 Installation Overall Comment

As mentioned, in order to install the Baercom PC v2.2 software, the 'Setup.exe' program inside the BC22 folder needs to be 'run'. The directions above show one such approach, and others are possible. For the different versions of the operating system, there can be a number of different approaches, and details may vary slightly. The result should be the same however.

3.4 Installing the USB Drivers

Installation of the USB drivers allows the BAERCOM-PC software to access the BAERCOM unit through the USB interface built into the BAERCOM. These drivers **MUST BE INSTALLED** or the BAERCOM-PC software will NOT be able to communicate with the BAERCOM !!! **And, by the way, you don't need to bother with 'Com Port' numbers any longer!**

A folder named "Drivers" is also included in "BC22 Publish" on the CD. This folder contains the information needed to install the correct USB Interface driver files on your computer.

How you proceed with this process depends on which operating system you will be using with the BAERCOM-PC software.

3.4.1 Windows™ Xp and previous versions

A second "setup" program has been included on the BAERCOM-PC software CD (in the Drivers folder) that performs the installation of the USB Drivers required by the BAERCOM USB Interface. The name of this USB "setup" program is "CDM20814_Setup.exe" (or something similar).

This program must be "run" in order to install the USB Drivers. The easiest way is to use the Explorer (sometimes My Computer or Computer) to locate the file (on the CD drive), and then "double-click" over it to direct the operating system to "execute" or run it. The actual time required by this program is very short.

After the drivers have been installed, the USB Setup program will open a window indicating successful completion. On some operating systems, it may just close. After closing any message windows, you can operate the BAERCOM-PC software to 'Locate', and access the BAERCOM traces from the PC. We recommend restarting your computer before continuing however.

3.4.2 Windows™ Vista and newer versions

Under newer operating systems, you generally can't force the installation of the USB Drivers. Instead, you must wait **until the first time** you connect the BAERCOM to one of the USB ports of your Computer. AT THIS POINT, the operating system will attempt to install the drivers for the BAERCOM USB interface. (The BAERCOM does NOT need to be turned ON for this process to work.) There are a number of variables for this process. Please read the options below **carefully**!

a. For some computers, the operating system will NOT know where this information is located, and will open a window asking you to 'browse' to the LOCATION of the driver information for the BAERCOM USB Interface. You will need to direct the operating system to look in the DRIVERS FOLDER on the BAERCOM-PC software CD for the information it needs to correctly install the drivers for the BAERCOM USB interface. Once the operating system has this information, it should pull the drivers from the CD, install the necessary information, and complete the driver installation process.

b. For other computers, especially if your computer is connected to the Internet, your computer may simply go online, locate, download then install the necessary drivers, requiring no other action on your part.

c. However, for other Internet connected computers, this process may stall for some reason, and the drivers will NOT automatically install. The only cure for this is to disconnect the Baercom from the computer, turn the computer off, temporarily disconnect the Internet cable from the computer (or turn off WiFi if that is in use), wait 30 seconds, then start your computer, and wait for it to complete its startup, then plug the Baercom back into your computer. With no internet connection, the operating system will quickly open a window that allows you to browse to the appropriate USB drivers on the Baercom-PC software CD. The USB driver installation should progress normally from there, and you can re-connect the Internet to your computer after the USB installation is complete.

Note that small "balloon" messages usually show up in the lower right corner of your computer as this process takes place, regardless of the approach taken by the operating system. Watch these, and allow the installation process to complete.

And we just need to note this again! **The Baercom-PC software will NOT be able to communicate with the Baercom UNLESS these USB drivers are properly installed!**

3.5 Notes about the <u>overall</u> installation process

The overall software installation process required by the BAERCOM system should generally prove relatively straight-forward. However, there are a few comments that might prove helpful.

3.5.1 Target Folder Note

Especially with newer versions of the operating system, there seems to be an increasing variability as to WHERE the BAERCOM-PC software will be installed, and WHERE your saved data files will be located.

The actual location on your computer's hard drive where the operating system installs the BAERCOM-PC software may not be that important. However, you can easily use the "Search" function of the operating system to find the program file, named "Baercom22.exe" for version 2.2.

More importantly, various versions of the operating system may try to save your BAER report files in a "My Documents" folder. Locating your report files buried in the "My Documents" hierarchy after they are saved, this can be a very frustrating task! However, this seems to increasingly be the location of choice.

Also, if you wish, you can create a folder on your hard drive specifically for your BAER report files, and always direct the BAERCOM-PC software to save the files there. You can also use the operating system Search function to locate the BAERCOM-PC program file, and then direct the BAERCOM-PC program to save your report files there.

However you decide to approach this, make sure that you know where to look for your files! And you may run into write-permission issues with some folders on some operating systems, so <u>always</u> check the <u>first time</u> you save a file to a particular folder, to make sure your file actually made it there! If not, you will need to change the *properties* of that folder to allow write access, then try again.

3.5.2 Com Port assignment <u>no longer</u> matters

Previous versions of the BAERCOM-PC software required that you check, and adjust if necessary, which "Com Port" the operating system assigned to the BAERCOM. ***For version 2.1 and newer, this requirement is no longer valid, since the Com Port setting is ignored by the BAERCOM-PC v2.1 and newer programs!!!***

3.5.3 New Installation – Most frequent issue

So you have had your Baercom for a while, and you just got a new computer, and installed the software from the CD, but it doesn't work; it won't Locate the Baercom. Or you used the electronic download for a different computer… The single most common issue in such situations is **failure to install the USB drivers as well**.

If your new computer is connected to the Internet, it may bail you out, and download the USB drivers for you, the first time you connect the Baercom to your computer. This process takes a minute or two, so let it finish. Either way, the USB driver installation needs to be done so the Baercom-PC software can talk to the Baercom!

3.6 Electronic Download Overview

UFI offers an 'electronic download' of the contents of the latest Baercom-PC Software CD for situations where your computer does not have a CD drive, or maybe you recently switched to a different computer and you have misplaced your original CD. The version downloaded will be the most recent version of the Baercom-PC software (v2.2 currently), but this should not be a problem.

You will need to contact UFI with your Baercom serial number handy, so we can verify your Baercom. We will then supply access information for the UFI "FTP" site so you can perform the download.

The Baercom page of the UFI web site includes a link to **detailed directions** for this Electronic Download process. **READ THESE DIRECTIONS FIRST !!!**

- www.ufiservingscience.com/baercom.html

The crucial point to be made is that the electronic download **does NOT automatically install** the Baercom-PC software! It simply places a folder on your computer named "BC22" that is an exact copy of the same folder on the CD shipped with new Baercoms. You will **STILL** need to follow the directions above to install **BOTH** the Baercom-PC software **AND** the USB Drivers on your computer **BEFORE** you can use the Baercom-PC software to "Locate" and access the Baercom!

The ONLY change with the installation directions as included above, is that the BC22 folder is on your "C:" drive, and not on a CD in your CD drive. The entire installation process is otherwise the same, and **MUST STILL BE PERFORMED for BOTH the Baercom-PC software AND the USB Drivers!!!**

Section 4: Using the BAERCOM-PC Software (v2.2)

4.0 Using the BAERCOM-PC Software, introduction

This section discusses the use of the BAERCOM-PC software. In order to exercise the software as described below, your computer should be booted up and the BAERCOM-PC software and USB drivers should already be successfully installed. Please perform these two tasks as described in section 3 if you have not completed the software installation process.

Also, if you plan on using the BAERCOM system with a live animal subject, then you will need to follow the directions in section 2 to connect the animal to your BAERCOM, and actually work through the BAER data trace collection process. However, rather than work on two 'learning curves' at the same time, it may be easier at first, to work through section 2 with an animal subject, and save some Baer traces in Baercom memory in the process. You can then, at some later point, work through this section (4) by downloading and reviewing BAER data traces from the BAERCOM that you saved previously. And, by the way, coming up to speed with the Baercom Simulator (Appendix C) can help simplify some aspects of acquainting yourself with the overall use of the Baercom system.

The BAERCOM-PC software main window arrangement focuses on the collection of a set of two (or four) Baer data traces, customarily one for the Left ear and one for the Right ear. This set of traces constitutes the measured hearing capabilities for a particular animal. However, you can also make a set of two traces for one ear: one trace of data *without* the click stimulus and one trace of data resulting *from* the click stimulus. While this may be helpful as you come up to speed on the use of the BAERCOM system, this approach is generally not used for reporting.

Also, the BAERCOM-PC software does not allow you to assign "Left" and "Right" labels to your trace data. This is because the software automatically detects the setting of the Ear Select switch at the time a BAER trace was collected and saved inside the BAERCOM. However, as mentioned above, these instructions repeatedly use the designations **Right** and **Left**. You can understand these directions as viewed from either the front of the animal, or from the back of the animal (the animal's Right and Left, preferred). **Whatever approach you choose, use it *consistently*.**

These instructions cover version 2.2 of the BAERCOM-PC software. The software version number can be found in the upper right corner of the welcome window displayed when the software starts up. (To access this window *after* startup, click once on the BAERCOM "dog icon" in the upper left corner of the software main window.) The left end of the main window title bar also includes version information.

4.1 Keyboard and mouse use

The BAERCOM-PC software includes a number of software "buttons" that respond to standard operating system controls and actions. You can also navigate to various text boxes and enter or modify text. To initiate the action a particular control represents you can usually do one of the following:

- You can ***click*** over the desired control with a mouse or other pointing device. This is probably the best, easiest and most accurate method.
- For controls labeled with an underlined letter, you can press the ***ALT*** key at the same time as the underlined letter. *[We know this is bazaar, but you need to briefly press the Alt key once to even **SEE** the underlined letters! And when you do this, any Baer traces will be erased! Don't panic, just press the Redraw button to restore the traces.]*
- You can also press the ***TAB*** key to cycle through text fields and buttons until the desired item is highlighted, then press Enter for buttons, or start entering text.

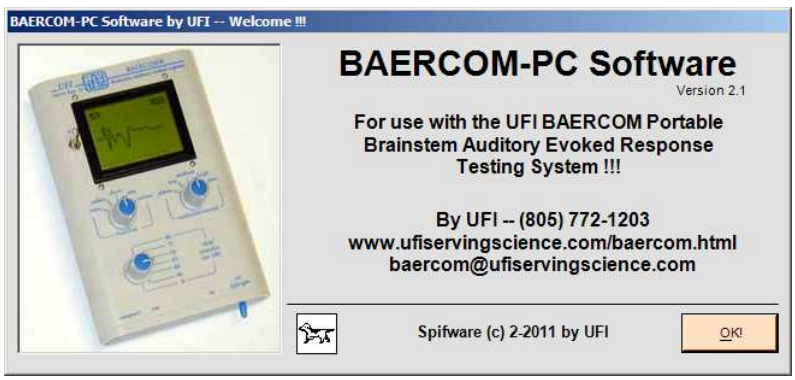
Note that this software generally enables and disables controls as appropriate for a particular task. For example, the download data functions cannot be accessed while reviewing previously recorded BAER data.

4.2 Starting the BAERCOM-PC software

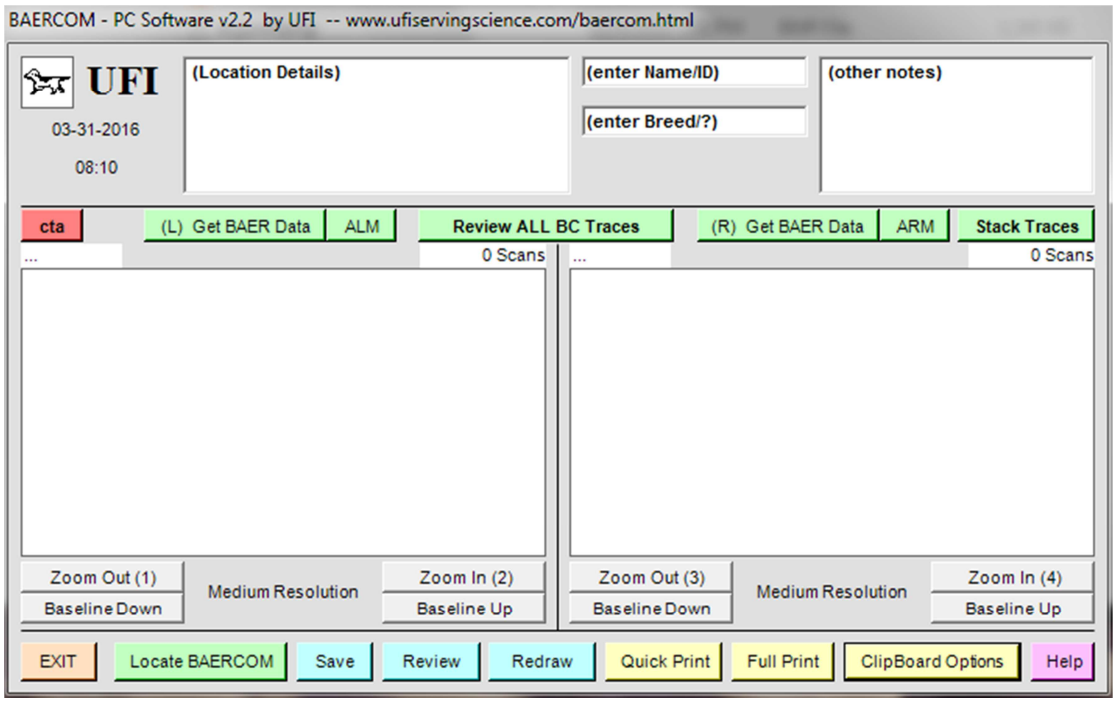
Starting the BAERCOM-PC software is simple:

1. Click the BAERCOM-PC software "Start Menu" item. (See section 3 if you have not yet installed the software.)

2. The software should open with an initial welcome window (v 2.2 is almost identical). Click **OK** to close this window and continue.



3. The BAERCOM-PC software main window opens, giving you access to the main software functions. The latest (V2.2) software is shown here, **but note that earlier versions are often used in the detailed instructions below!**



Compared with earlier Baercom-PC software versions, we have re-arranged the yellow buttons along the bottom, but control location and function is basically the same. However, you will note the five new buttons in the picture above. The **Review ALL BC Traces** and **Stack Traces** buttons normally will **NOT SHOW** until **AFTER** the software has both 'Located' a vD.2 Baercom, and has downloaded the entire Baer trace memory from that Baercom! We have included them here so you know what they look like, and where they are placed. The **ALM** and **ARM** buttons are used to add a second 'mirror' Baer trace to each of the trace areas. This capability works after ANY USB Baercom has been 'Located'. The red **cta** button clears the trace areas.

As before, there is **no Menu Bar** in the BAERCOM-PC software main window. You simply click on buttons or type into the text boxes to perform all desired actions.

4. To close the Baercom-PC software, click the **Exit** button at lower left on the main window or press the ALT key and "X."

4.3 Locating the BAERCOM unit with the software

Before the BAERCOM-PC software can communicate with the BAERCOM unit, the software needs to open up a communications channel to the BAERCOM through one of the computer's USB ports. (Note: this requires that the USB drivers are already installed on your computer as described in section 3 above!) The software uses the "Locate" process to discover and open this channel. Follow the steps below to work through this process.

1. If not already done, connect a standard USB cable from the BAERCOM USB jack (Section 2.2.3.3) to any available USB port on your computer. (Which USB port you actually use is not important.) Also, your computer should be on, and the Baercom-PC software should be running.

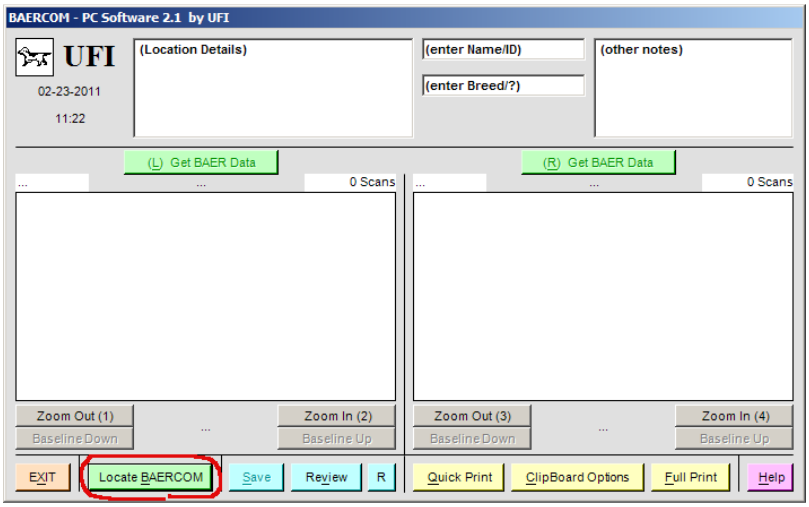
2. You will want the Baercom turned on, and to have completed the usual power on sequence. Now, in order for the software to 'locate' the Baercom, the Baercom must be displaying a Baer trace, in either SHOW or REVIEW. The reason for this, is because, while in (just) the SHOW or REVIEW positions, the Baercom **continuously** transmits the data for the Baer trace currently showing, and **THIS DATA** is what the Baercom-PC software is looking for, in order to **Locate** the Baercom!

   You may have just collected a Baer trace from an animal, and this trace is posted on the Baercom display in the SHOW position. And for the Locate process, you can also perform a COLLECTion for 1 or more Scans with **no animal connection**, then switch to SHOW. The resulting trace will be noise, or mostly flat, but the actual data does not affect the Locate process.

   You can also use the REVIEW position to post any of the traces held in trace memory inside the Baercom. One of these traces can be displayed, and the Baercom left in the REVIEW or SHOW position during the Locate process.

3. Next, click the green **Locate BAERCOM** button in the bottom row of buttons.

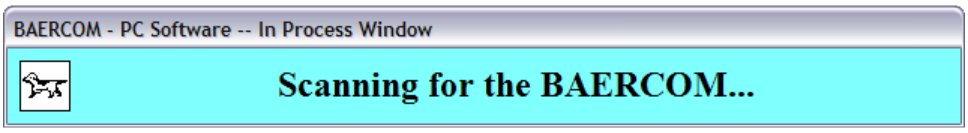
[Picture on next page]



As mentioned, the BAERCOM sends the current BAER data trace continuously (over and over) out the USB port when the BAERCOM function switch is in the SHOW (or REVIEW) position. The Locate process is simply looking for this continuous stream of BAER trace data.

4. Double-check that the BAERCOM **Function Switch** is turned to **SHOW or REVIEW**, then click **OK** on the next message.

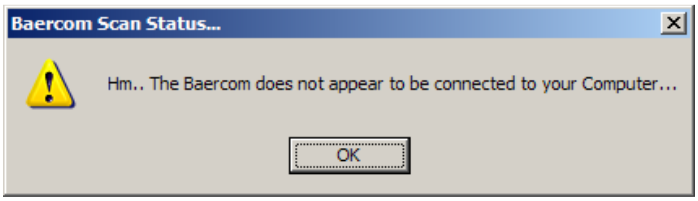
5. The following message window appears next, indicating the BAERCOM-PC software is checking the USB link for trace data from the BAERCOM unit:



6. Normally the scanning process takes just a few seconds, and is followed by this message (next page):

If the message indicates that the Baercom was 'found' (Located), you can now download BAER trace data from the BAERCOM to your computer as explained in Section 4.4. The v2.2 software also allows you to check if your Baercom has the v D.2 Baercom firmware, and will download all trace data if so. This is discussed in step #7 below.

If, however, you see the following message, or something similar, then the BAERCOM-PC software did ***not*** find the BAERCOM via the USB link!



Verify that the BAERCOM **Function Switch** is actually set to **SHOW (or Review)** and that a trace is posted on the Baercom display. Next, carefully re-check the USB cable to make sure the plugs on the ends are fully inserted into the jacks. Then click **Locate BAERCOM** again on the software main window to repeat the search for the BAERCOM unit over the USB link.

7. ***This next step in the 'Locate' process is ALL NEW with the v 2.2 Baercom-PC software!*** This latest software version can actually check if your Baercom has the v D.2 Firmware. If it DOES, the software immediately **DOWNLOADS ALL TRACE DATA** from your Baercom, and **THEN** makes the new **Review ALL BC Traces** and **Stack Traces** buttons visible and active!

   After your Baercom was 'found' (Located) as described above, the v 2.2 software **ALWAYS** opens a new message window **ASKING** if you want the software to check for the v D.2 Firmware in your Baercom. You can select "**NO**" to decline and skip this test! Maybe you already know your Baercom is v D.1 or earlier. Maybe you are moving 'just collected' Baer data from your Baercom to the Baercom-PC software, and you don't need any traces in memory for this. Skipping this test doesn't cause any problems, and the Locate process is done after this message window closes.

If you **DO** want to continue with the v D.2 Firmware check, press the **YES** button on this new message window. This window will close, and another message window will open. This next window directs you to move the Baercom Function (left) switch to the REVIEW position if it is NOT already there. (The v D.2 Baercom can only respond to this check while in REVIEW!) After you have set the Baercom to REVIEW, press the OK button to continue with the test. This test should be done in 5 seconds or less.

If your Baercom operating firmware is v D.1 or earlier, a message window opens, indicating this. The Baercom web page address is posted too, since it includes some upgrade options for older Baercoms. Close this window to complete the Locate process. Even though your Baercom has an earlier version of the firmware, you can still use the v 2.2 Baercom-PC software!

If your Baercom DOES have the v D.2 firmware, the Baercom-PC software will immediately download all 32 pages of trace data (used or empty) from your Baercom, and place all these traces into working memory as a 'Trace Memory Image'. Both the **Review ALL BC Traces** and **Stack Traces** buttons will then be made visible and active. After a slightly longer delay, the software opens a message window summarizing all of this. Closing this window completes the Locate process.

The overall Locate process should be fairly straight-forward. But whether you access Baer traces one at a time from the Baercom, or download the trace memory array (vD.2 Baercoms only), the Locate process must be your first step.

Locating the link to the BAERCOM needs to be done once, and then you can download as many BAER data traces as you like from the Baercom, usually from trace memory inside your Baercom. However, you will need to repeat the Locate process if you do any of the following actions.

a. Close the BAERCOM-PC software then open it again.

b. Stop accessing the BAERCOM unit and using the REVIEW function to load in previously saved BAER reports from your computer hard drive, and then desiring to download more data traces from the BAERCOM unit.

c. Disconnect then re-connect the USB cable between the BAERCOM unit and a USB port on your computer. ***(See important note below!)***

This last action (USB disconnect then re-connect) is worth more discussion! We recommend that you disconnect the USB cable from the BAERCOM unit USB connector during BAER data collection, to help minimize noise injected into the BAERCOM from the computer. If you follow this recommendation, you will need to work through the "Locate" process after each time you plug the USB cable back into the BAERCOM. **And, with the v2.2 software, subsequent 'Locate' processes (after disconnecting then re-connecting the USB) do NOT erase Baer trace data already downloaded!** You may need to press Redraw, but the data is not cleared beyond the first 'Locate' process.

4.4 Downloading a BAER data trace to your computer

Once the BAERCOM-PC software has located the BAERCOM, the software buttons labeled **(L) Get BAER Data** and **(R) Get BAER Data** above the two trace plot areas are activated. The "L" and "R" in these labels simply indicate which of the two data plot areas will receive the downloaded data trace. The actual "Selected Ear" information is taken from the downloaded trace data and is posted, just as recorded, regardless which plot window the data is directed too.

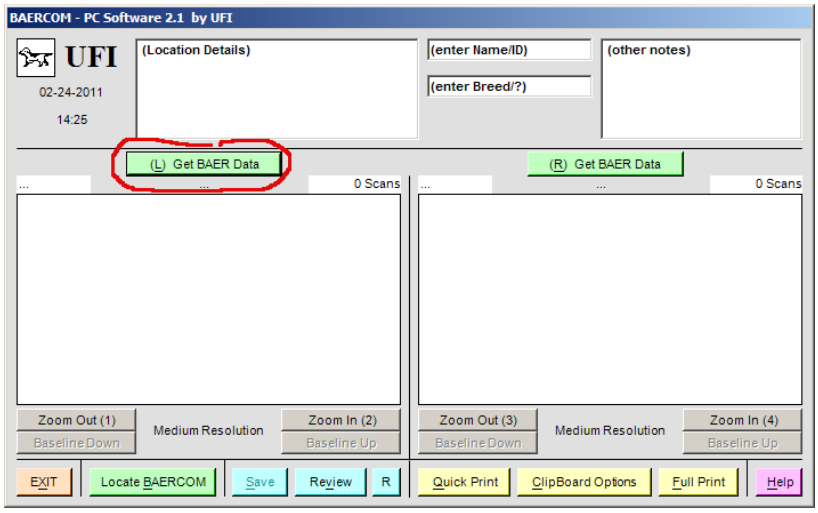
But customarily, you will want to download a trace labeled Lxxx (Left ear trace) on the BAERCOM unit LCD display into the Left plot area in the BAERCOM-PC software, and a trace labeled Rxxx (Right ear trace) to the Right plot area, and these instructions generally assume this approach. This is not required however, if you prefer different arrangements. Either way, you can't over-ride the actual Ear Selected information in trace data.

And note that the v2.2 software uses the 'as recorded' ear select information in the trace data to 'color-code' the trace plotting in most software trace plot areas. Right ear traces are plotted in Red, and Left ear traces are plotted in Blue. (Magenta is often used for empty / erased traces.)

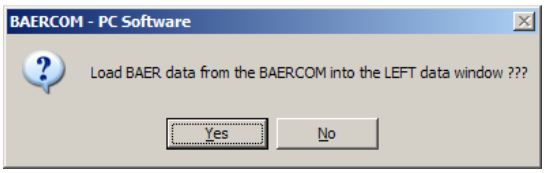
Follow these steps to download a BAER data trace from the BAERCOM unit to the BAERCOM-PC software.

1. Be sure that the BAER data trace you want to download is visible on the BAERCOM LCD display, and that the **Function Switch** is set to **SHOW or REVIEW**.

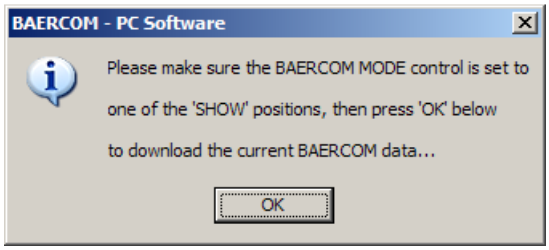
2. Assuming your BAERCOM unit display shows ***left-ear data*** (display shows Lxxx), click the BAERCOM-PC **(L) Get BAER Data** button:



3. This message appears. MAKE SURE you don't mind over-writing any trace already present in the Left software trace area, then click **Yes**. (Click No if you realize you want the trace currently posted!)

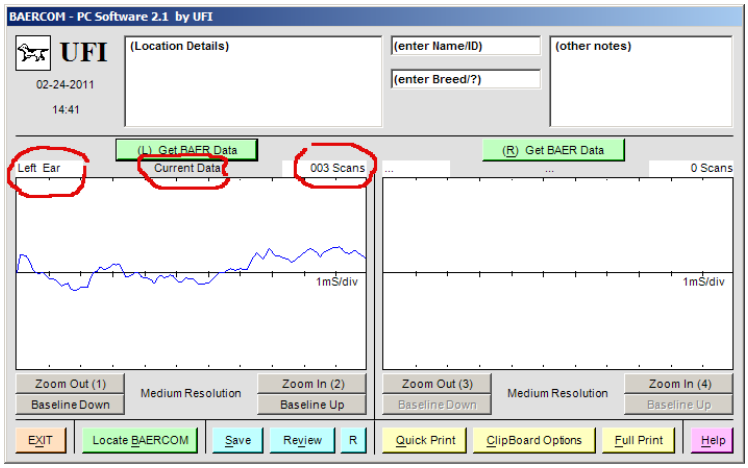


4. Click **OK** on the next message, which reminds you to set the **Function Switch** to **SHOW (REVIEW works too)**:



5. An in-process window should post briefly, while the software accesses the USB link and waits for a complete BAER data trace from the BAERCOM.

6. After receiving the trace data, the BAERCOM-PC software main window should show, now with your BAER data trace posted in the left trace area. Three items are posted along with the trace data, shown directly above the plot area on the main window.
    - ***Which ear*** the data comes from (left in this case)
    - the BAERCOM ***internal memory page, if any***, in which the BAER trace was saved, or "**current data**" if the trace was just collected as here
    - ***how many scans*** were made to collect the data (three, here, for example purposes; you usually won't see much Baer until 10 or more scans.)

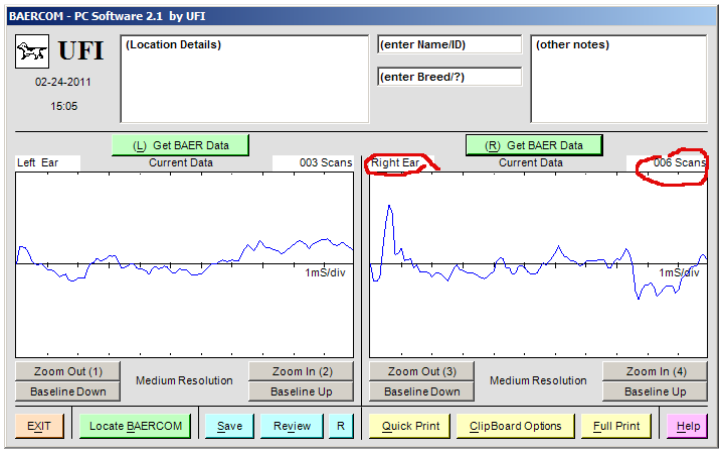


(Note again that this is meaningless test data since we are focusing only on the mechanics of using the software.)

If you now wish to download a ***right-ear*** trace, perhaps to show a complete test of both of a subject's ears, just follow Steps 1 through 6 above. However, before you do this, you will first need to either perform the BAER data collection process to collect the Right ear trace, or use the controls on the BAERCOM to access and post a memory page that contains a Right ear trace, on the BAERCOM LCD display. After this is done, you can then follow steps 1 through 6 above. This time, however, click the BAERCOM-PC **(R) Get BAER Data** button in Step 2.

[Picture on next page]

When the right-ear trace data has been downloaded, your main window will look something like this.



Again, this data is meaningless noise as we focus on the actual use of the software. Note however that the v2.2 version of the software plots Left ear traces in Blue, and Right ear traces in Red. This v2.1 screen-shot doesn't show this.

And you need not download Left-ear data before Right-ear. The actual order in downloading does not matter, and the actual information about which ear the data represents, is taken from the trace data, and cannot be changed.

The window below shows what happens if you download the sample BAER data saved in page 24 (page 32 for v D.2 Baercoms) on the BAERCOM, into BOTH sides of the BAERCOM-PC data plot areas, and is included as an illustration. *The v2.2 software plots both traces in Red (Right ear).*

4.4.1 Comments about the downloading process

Here are a few comments that may prove useful when downloading Baer traces from the BAERCOM to the BAERCOM-PC software.

- While it is not necessary, it may still be a good idea to save all collected BAER data traces to memory pages in the BAERCOM unit, so that you have a copy saved in case something happens while downloading. Note however, that the use of the BAERCOM's internal memory requires that you **carefully document EACH** memory page; which ear, which animal, etc.

- A BAER data trace showing on the BAERCOM LCD is continuously sent to your computer *as long as* the BAERCOM ***Function Switch*** is kept in the ***SHOW*** *or* ***REVIEW*** position. This means you may download the same trace repeatedly ***without*** repeating data collection with the electrodes, should this prove helpful. For example, if you accidentally download the trace to the wrong side of the software main window, just load it into the other side and continue. The data trace being received from the BAERCOM will not change until you change the data showing on the BAERCOM unit LCD.

- If there is a USB data link error during downloading (a very rare event which we have never seen), the data in the BAERCOM-PC plot area may look very erratic even when the data looks fine on the BAERCOM display. If this happens, simply click the **(L) Get BAER Data** or **(R) Get BAER Data** button again and repeat the Baer trace download. The trace showing on the computer may be larger, but should still look just like the Baer trace shown on the BAERCOM LCD.

- If you ***accidentally download*** trace data into a BAERCOM-PC plot area, any trace data previously in that area ***will be erased***, over-written. (This is why the software asks a second time if you wish to proceed.) If this erased data trace was data you realize you wanted to save, recovery from this mistake can go either of two ways:
    - If the trace that you erased came from one of the BAERCOM internal memory pages, just download that trace again to the software, carefully choosing the correct side of the report.
    - However, if you ***did not save*** the over-written trace data to BAERCOM memory, you will need to ***repeat the data collection process*** with the electrodes. You might want to store the new data to the BAERCOM before you again download it to the BAERCOM-PC software.

4.5 *New v2.2 Additions*: Trace Mirroring / Browsing / Stacking

This entire section (4.5) is new to the Baercom-PC software (v2.2)! This new software version brings three powerful capabilities; Trace Mirroring, Trace Browsing and Trace Stacking. The last two additional capabilities are only available **IF** the software has located a vD.2 Baercom, and **THEN** successfully downloaded all 32 memory pages / traces from the Baercom! This complete 'trace memory image' is the basis upon which both the Trace Browsing and Trace Stacking are built.

(4.5.1) Trace Mirroring allows you to add a second 'mirror' trace to each of the two trace areas. As we keep saying, if it is the Baer you are seeing, the results will be very close, one Collection after another. This Mirroring capability allows you to add a second Mirror trace for each trace area. The whole point is that the Baer trace for a second data collection should 'mirror' the first Baer trace, when taken on the same ear of the same animal for the same number of scans. **Many records bodies now require two traces for each ear!** And note that this Trace Mirroring capability works with **ANY** USB Baercom!

(4.5.2) Trace Browsing supplies a much faster way to move the two or four Baer data traces to the trace plot areas on the Baercom-PC software main window for a report. Simply pressing a button opens up a second window holding all 32 traces just downloaded from your Baercom! Browse to the page / trace you are after, double-click over that trace, select which side of the report, and the trace is there!

(4.5.3) Trace Stacking allows up to 5 Baer traces to be 'stacked up'; all five traces plotted, one on top of the other, on the same data plot area! Color-coding links each trace to the other details of the trace (Ear Select, number of scans) and other brief notations. A huge text space along the bottom provides room for additional notations (animal details, practice info or anything else), and the contents of this bottom text box are 'remembered', and restored the next time you again open the Trace Stacking window! This powerful tool can serve as a condensed report, or as the basis for more 'in depth' Baer research.

As mentioned above, the 'trace memory image' can (only) be downloaded from your vD.2 Baercom during the 'Locate' process, and this image is the source for trace data used for both Trace Browsing and Stacking. Only vD.2 Baercoms can supply this image! We do have Baercom upgrade options in place. Go to our Baercom web page (www.ufiservingscience.com/baercom.html) for the latest information!

4.5.1 Trace Mirroring

As we keep saying, if it is the Baer you are seeing, the results will be very close, one Collection after another. This new Trace Mirroring capability allows you to add a second 'mirror' trace for each ear, to the trace areas of the Baercom-PC software. The basis of this process is that the Baer trace for a second Baer trace Collection should look very similar to, it should 'mirror' the first Baer trace, when taken on the same ear of the same animal for the same number of scans. The Trace Mirroring capability allows you to add this second trace. **And many records bodies now require two traces for each ear!** This is just a good idea.

Many of the example screen-shots in these directions show an earlier version of the software. For the purposes of most discussions, this doesn't make much difference. We have tried to avoid making substantial changes to the arrangement and function of the controls on the Baercom-PC software.

A screen shot of the main window of the latest version (2.2) of the Baercom-PC software is shown on page 65. Please refer to this image briefly. The **(L) Get BAER Data** and **(R) Get BAER Data** buttons are still located above the trace areas. These two buttons work as they always have, and allow you to add Baer trace data from the Baercom to the trace window below them. The use of these two buttons to download Baer traces is described in section 4.4 above.

From the v2.2 screenshot, you will also notice that we have squeezed these two big buttons a little smaller, and have added a new, small button next to each. The NEW button on the left side is labeled "**ALM**", short for Add Left Mirror. The one added on the right shows "**ARM**" for Add Right Mirror. After you have used the big button to add a Baer trace to a trace area, you can press the adjacent smaller button to add a second, Mirror trace to that **same** trace area.

However, you can't add just *any* trace as a Mirror trace! The software will NOT add the Mirror trace UNLESS **BOTH** the Ear Select and Number of Scans AGREE! In other words, as you attempt to add a Mirror trace, the software actually checks the trace you want to add, evaluating both the *Ear Select* and *Number of Scans* information. The software will NOT add the Mirror trace unless these two pieces of information exactly match the trace that is already in place! This is only to be expected; the Mirror trace should the taken from the same ear of the same animal for the same number of scans. The software enforces this requirement.

Adding a Mirror trace assumes that you have already added the first Baer trace to the trace area. But the directions below cover the entire process (both traces). Using this Mirroring capability, for the LEFT trace area works like this.

- First, press the **(L) Get BAER Data** button and follow the directions in section 4.4 above to add a Baer trace (the first one) to the LEFT trace area. It is a good idea to quickly verify that the trace showing on the Baercom LCD, and just downloaded, matches the trace showing in the trace area after downloading.
- Work with the controls on the Baercom to make sure that the trace you wish to add as the second, Mirror trace is showing on the Baercom LCD in either the **Show** or **Review** settings.
- Now press the **ALM** (Add Left Mirror) button to direct the software to download this second, Mirror trace to the trace area. The software will post a new information window first, overviewing the Mirror process, reminding you that a trace should already be present in the trace area, and asking you if you wish to proceed. Press the OK button to continue.
- If there is NOT a trace in the trace area yet, the software will open a window alerting you about this. The software will not continue with the Mirror process. Close this window, then use the **(L) Get BAER Data** to add the first trace.
- If the software detected a trace already present in the trace area, the software will allow you to again follow the trace download process described in section 4.4, in order to download the second, Mirror trace. The text directions may vary slightly, but the same overall trace download process is followed.
- After the second trace is received by the software, it will check to see if the Number of Scans and Ear Select information from this second, Mirror trace just downloaded, exactly matches the information for the trace currently in place. If it does not, the software will post a message about this, and will not add the trace just downloaded as the Mirror trace. You will need to find the proper Mirror trace, and repeat this process to download that trace.
- If the Number of Scans and Ear Select information of the Mirror matches the trace already there, the software opens an information window noting this. This window also indicates that the Up and Down buttons will work on the first trace, but NOT the Mirror trace. After you close this information window, the trace just downloaded will be added to the Left trace area, along with the trace that is already present. You should use the Up and Down buttons to move the first trace such that both traces are easily discernable. The vertical location of both traces is not too critical as long as all of the peaks and troughs are visible. Of course, both traces should be almost the same.

- You may note that the Number of Scans and Ear Select information for the second, Mirror trace are not posted. Since they are the same as the initial trace, this should not matter. This same information applies to both traces. However, the trace source posting (current data or actual trace memory page) will continue to reflect the initial trace, and is not changed. This information is really secondary however.
- If you later press the **(L) Get BAER Data** button after a Mirror trace has been added, and is showing, you will be able to download a NEW 'initial' trace into the trace area as usual. However, this action will ERASE any Mirror trace currently showing. This is expected behavior. The Mirror trace is paired to a specific initial trace. When you load in a new initial trace, the Mirror trace is no longer valid, and so is removed. You will need to repeat the above procedure to download the Mirror trace for this new, initial trace.

The use of the Baercom internal Baer trace memory allows Baer traces to be stored inside the Baercom, then later downloaded to the Baercom-PC software for report generation. This internal storage capability has been present since the first Baercoms were available. And we have mentioned that you must **carefully document** which memory locations/traces go with which animal. When you use this Trace Mirroring capability, it is **EVEN MORE IMPORTANT** to carefully document which traces go with which animal. This is because each animal will have **FOUR traces** associated with it, not just two! And, in addition, the Number of Scans and Ear Select information for the two mirroring traces should exactly match the 'initial' traces for each ear! There is just a lot more record-keeping and careful checking that will need to be done when using the Trace Mirroring capability with traces taken from Baercom trace memory.

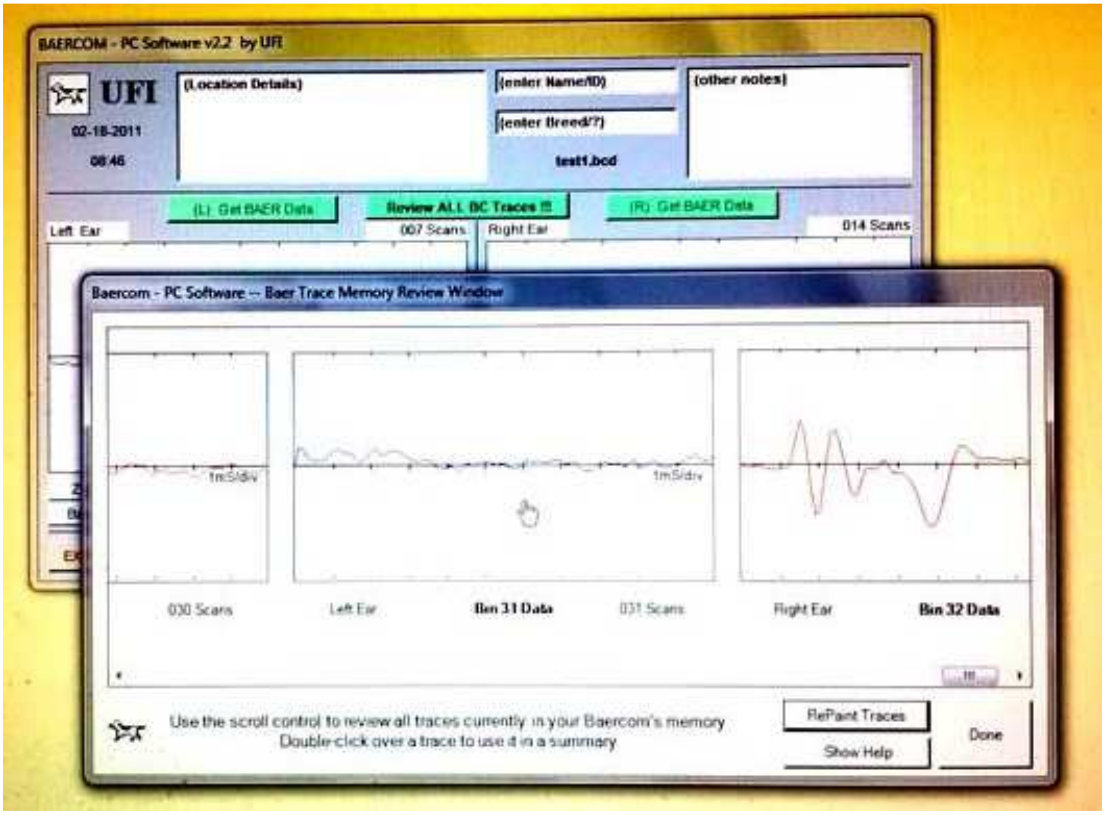
Note that, after adding any Mirror traces to the trace areas, **BOTH** traces (initial and Mirror) are retained for all other actions that use the software main window. The **Redraw** button will bring Mirror traces back too. Any Clipboard or Print functions will also show added Mirror traces. Actually saving a full report (traces plus comments) with a Mirror trace present, results in a much larger saved data file, as the Mirror traces are saved too. However, the Baercom-PC software automatically handles this difference in file size, both when saving and also when reviewing a report that includes mirror traces. This whole process has been made as transparent as possible. Any Mirror traces added are seamlessly included in the overall capabilities of the Baercom-PC software. Also, report data files saved with previous versions of the software can still be loaded back into the v2.2 software for review, printing, etc.

And we need to note this again. This added Trace Mirroring capability works with **ANY** USB Baercom!

4.5.2 Trace Browsing

As a part of the 'Locate' process (discussed in 4.3 above), the v2.2 Baercom-PC software ASKS to check your Baercom for the vD.2 firmware. IF you select YES and IF the vD.2 firmware is found, the v2.2 Baercom-PC software will first download the entire Baercom trace memory, all 32 pages, placing everything in a 'trace memory image'. Then this software will activate the **Review ALL BC Traces** button (for Trace Browsing), as well as the **Stack Traces** button. ***The descriptions for both Trace Browsing (this section 4.5.2) and Trace Stacking (next section 4.5.3) that follows, ASSUME that both of these buttons are already showing!***

Pressing the **Review ALL BC Traces** button immediately opens the Trace Browsing window. A (poor) image for this is shown below.



The 32 pages / traces just downloaded from your Baercom are plotted in 32 data windows arranged in a scrollable horizontal pane. You can use the horizontal Scroll Bar along the bottom of the pane to move around, and review the traces. This arrangement allows you to quickly scroll through, to browse all 32 traces!

If you try to scroll too fast, some of the data plots may be left out; the operating system places limits on how fast you can scroll through! Just press the 'Repaint Traces' button at any time to fully paint the traces showing.

This trace browsing window is larger the first time you open it. The lower border is moved down, and some text hints are included to direct you through your first few uses of this trace browsing window. Press the 'Hide Help' button to shrink this window to the size shown above. It will stay this way until the next time you start the Baercom-PC software. You can move it too, and it should stay put!

You can press the 'Done' button to close this trace browsing **window** without selecting a trace. Normally, you would **not** do that; you came here to select a trace to add to your report! To do this, scroll through until you find the trace you wish to add. You can verify memory page number, ear selected and number of scans from the annotations below each trace. After you have found your trace, just **double-click** anywhere over the trace window for that trace to select it! The software will open a small message window to allow you to select the Left trace area or the Right trace area as the **destination** for the trace you just selected. Make this selection, and this message window and the trace browsing window will close. The trace and details (Ear Selected, etc.) will show on the report, on the side you selected. That's it! And, you can add the next trace in maybe 20 more seconds. It's just a lot faster.

You will also see the memory page note has "(F)" at the start. This just indicates the data was transferred through the full memory download, i.e. it was brought in from the 'trace memory image' downloaded during the last 'locate' process. This is really just a secondary consideration however.

And, by the way, the USB link used to download traces from the Baercom is usually fairly robust. But if you ever note from the browsing window that the data showing looks crazy and erratic, don't hesitate to repeat the whole 'locate' process, allowing the software to check for the vD.2 firmware, then downloading the 'trace memory image' again. We have never seen this mess up, but just keep an eye out!

Still, let's say you just performed both ear Baer tests on a litter of 9 puppies. If you have the v2.2 software and the vD.2 firmware, you can work through the 'locate' process (once), let the software download the 'trace memory image', then grab your notes and start building reports. You really don't need to touch the Baercom again until later, when you maybe want to erase all Baer traces in preparation for the next litter! And if you have the vD.2 firmware, this erase process takes less than a minute!

4.5.2.1 Trace Browsing and the Mirroring Capability

Please read through ALL of section 4.5.1 and 4.5.2 above, before continuing. This section discusses the use of the Trace Mirroring capability, while also using Trace Browsing. Sections 4.5.1 and 4.5.2 are crucial background for this discussion.

The Trace Browsing capability can also be used to add Mirror traces to the trace areas of the Baercom – PC software. Generally, in order to load in a (first) trace, you pull up the Browsing window, then double-click over the desired trace to add it to a trace area. After you do this, the software asks you to select which "side", which trace area you wish to add the selected trace to. Once this selection is made, you are done, and the trace is placed in the selected window.

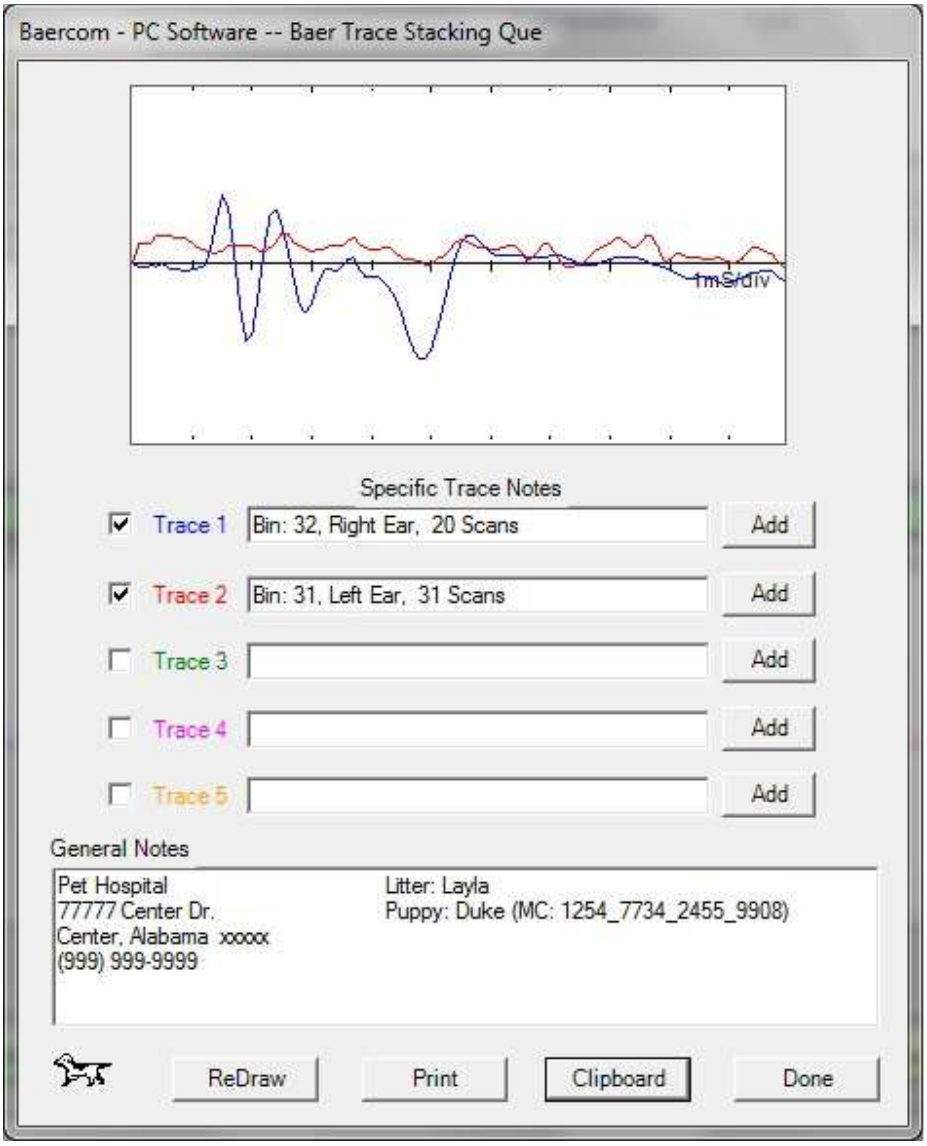
HOWEVER, if there is a trace ALREADY in place on the side you selected, the software needs to ask you for one more piece of information. A new information window is opened to ask you if you want to OVERWRITE the (initial) Baer trace in the trace area, or if you want to ADD the 'just selected' trace as a Mirror trace to be paired with the Baer trace ALREADY in the trace area. Again, which button goes with which selection should be fairly clear. Press **Yes** to overwrite the (first) trace already present, or press **No** to add the trace selected as the Mirror trace for the trace already there. Pressing either button will close this second information window.

- If you pressed **Yes** (to overwrite the trace already there), the software will just add the new trace and information to the selected trace area / side, and the trace already present will be lost. If there was a Mirror trace already present as well (i.e. there were two traces), the Mirror trace is also removed.
- If you press **No** to add the selected trace as a Mirror, the software checks the Ear Select and Number of Scans information for the trace you want to add as a Mirror. If the information matches, a message window opens indicating this, and also mentioning the **Up**/**Down** buttons work only for the first trace. After closing this information window, the selected trace will be added as a Mirror trace. You should use the **Up**/**Down** buttons to move the first trace so that both traces are easily discernable.
- If the information does NOT match, the software will NOT add the selected trace as a Mirror! It will open up an error message indicating the problem. After closing this window, you should open up the Trace Browsing window again, and select the proper Mirror trace.

4.5.3 Trace Stacking

Sometimes it can be handy to actually 'stack up' multiple traces, one on top of the other, in order to maybe make some careful comparisons. The Trace Stacking window allows you to do this! Up to five traces can be stacked together. And this stacking window can serve as a condensed report format as well.

Press the **Stack Traces** button to open up this new window. A screen shot for this window is shown below.



If you don't see the **Stack Traces** button to begin with, note what was mentioned above. As a part of the 'Locate' process (discussed in 4.3 above), the v2.2 Baercom-PC software ASKS to check your Baercom for the vD.2 firmware. IF you select YES and IF the vD.2 firmware is found, the v2.2 Baercom-PC software will first download the entire Baercom trace memory, placing everything in a 'trace memory image'. Then this software will activate the **Review ALL BC Traces** button (for Trace Browsing), as well as the **Stack Traces** button. ***The descriptions for both Trace Browsing (section 4.5.2) and Trace Stacking (this section, 4.5.3) that follows, ASSUME that both of these buttons are already showing!*** The description included here assumes that the Locate process accessed a vD.2 Baercom, downloaded the Trace Memory Image, and activated the **Stack Traces** button. It assumes also that this button has already been pressed, and the Trace Stacking window (image shown above) is visible.

The data plot area at the top of this window holds the actual Baer traces for the up to five traces that can be added. No traces are present each time you open this window. To add a Baer trace, simply press the 'Add' button to the right of the line / color you choose. And, by the way, you can add traces in any order, and using any of the included colors. The color used for each added trace is the same as the color used for the "Trace x" labels to the left. And note that the selection of colors made here ignores the colors used everywhere else (Red for the Right ear and Blue for the Left ear, Magenta for empty data). The example above already has two traces added.

Pressing one of the 'Add' buttons jumps you straight to the exact same Trace Browsing window used to select a trace for the main report window. After pressing 'Add', the Trace Browsing window opens, and allows you to browse all 32 traces. The browsing process works in the exact same way; you double-click over the trace plot area of the trace you want to add. The trace browsing window closes, and the trace is added to the 'stack', using the color of the line you selected. Trace details (ear selected, number of scans, memory page /' bin') are added in the text box to the left of the 'Add' button you first pressed. And you can add **more** text to these text boxes if you want!

The 'check boxes' to the left are 'checked' as you add more traces. However, we left these check boxes active! You can un-check a box, press the Redraw button, and that trace will be temporarily omitted from the stack. If you later check the box, then press Redraw again, it will be back in the stack. This makes it easy to evaluate just a subset of all the traces you have added, without having to leave, come back, and start over!

The text box at the bottom of this window is very big, and can be used for many different things. The example above suggests some sort of hearing report annotation. The only thing you need to remember about this text box, is that the contents are 'remembered' between uses! Whatever you type into this box during the time it is open, that is saved when you leave. The next time you open the Trace Stacking window, it will all be back, just like you left it, even a week later!

What can you do with this Trace Stacking window when you are done with it? Well, you can Print it if you want, by pressing the **Print** button. The individual traces are different colors, so a color printer works best. You can also press the **Clipboard** button to transfer an image of the Trace Stacking window to the Clipboard. You can then open up your favorite graphics program, paste it in, and Save it in any format you choose. The Trace Stacking window currently has no built-in Save / Review mechanism.

4.5.4 Clearing the Trace Areas (cta button)

This new **cta** button was a last minute addition. In order to enhance our testing of the Baercom-PC software v2.2, we added a small button to the main window that allows both trace areas to be 'cleared' with just one button press. This new, small button is labeled **cta** (for clear trace areas). This button is above the left trace area.

We colored this button **RED**, because you ***normally do not want to do this!*** Once you press this button, the trace areas and the four Baer trace data buffers are cleared, and the trace information is replaced with start-up (no data) indications. (All text areas are left as is.) This action cannot be reversed! You will need to bring two or four Baer traces back into these windows after this button is pressed. To minimize the risk of accidentally pressing this button, you can't land on it by pressing the Tab key, or any other keyboard keys. You can only press this button using the mouse!

We decided to leave it in, because there may be times it will come in handy for you, especially if you are using Trace Mirroring, and adding four traces to the trace areas. As you finish a report for an animal and save it, print it, etc, your ***next*** step will be to connect a different animal, and start collecting Baer traces, and adding them to the trace areas. With four traces already present, it can get **VERY confusing** what your next step is. And if you are doing a whole litter, or a bunch of puppies… The solution is to press the **cta** button after you are SURE you are done with one report, and are ready for the next animal. Pressing the **cta** button gives you a clean slate starting point, for collecting / adding the next set of Baer traces to the trace areas. That is why we added it to begin with. Again, text areas are not touched.

4.5.5 Final Comments

Trace Browsing and Trace Stacking are two powerful additions to the v2.2 version of the Baercom-PC software. However, if your Baercom has the vD.1 firmware or earlier, it should still work fine with the v2.2 software! You just won't have access to these two capabilities. If you want to explore upgrading your Baercom, we do have Baercom upgrade options in place. All you need to do is go to our Baercom web page (www.ufiservingscience.com/baercom.html) for the latest information!

You will, however, be able to use the new Trace Mirroring capability with **ANY** USB Baercom!

4.6 Working with BAER data

After downloading 2 or 4 ear's worth of BAER traces from the BAERCOM to the BAERCOM-PC main window, you will soon want to save that data, that report. This crucial task is discussed in section 4.7 below.

However, there are other capabilities of the BAERCOM-PC software that may be handy prior to actually saving your report. The following eight topics cover several important BAERCOM-PC software features and functions:

- the "Brief Instructions" window, which provides a quick reference card for the overall system
- how to document your BAER report with annotations, and the date and time display
- how to make a re-usable template for annotations
- how to redraw the plot traces if they disappear
- how to use the **Zoom** buttons to view a trace in greater or lesser detail
- how to restore a BAER trace baseline when it becomes offset too far
- how to use the expanded data window
- how to move BAER traces to the Clipboard

Saving, reviewing and printing BAER reports merit their own sections; these functions are covered in Sections 4.7, 4.8 and 4.9 below.

4.6.1 The Help / "Brief Instructions" Window

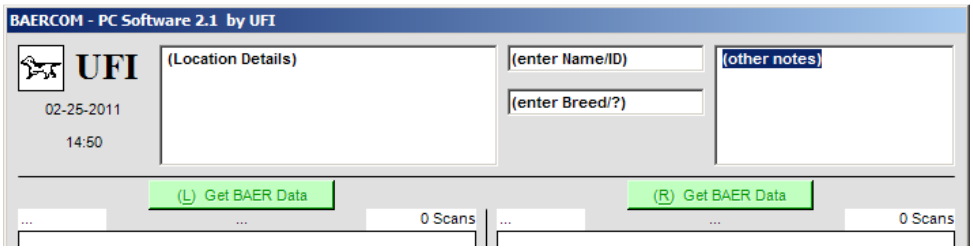
Press the pink **Help** button in the lower right corner of the main window to view a "Brief Instructions" window with the following headings.

- "BAERCOM Setup," which goes over electrode and Earphone placement
- "BAERCOM Use," which covers Baer data collection procedures
- "BAERCOM-PC Software Use," which details how to download data from the BAERCOM to the PC software
- "Plotted BAER Data", which provides information about the data traces

These four paragraphs serve as reminders and are NOT intended to replace this instruction manual. Press the pink **Done** button on the "Brief Instructions" window to close it and return to the main window.

4.6.2 Annotating a BAER report, and the date/time display

The BAERCOM-PC software provides four text-entry boxes just above the Baer data trace areas on the main window. You can add any text notes that you want to save or print out along with the BAER report itself. When the main window first opens, the text boxes look like this:



You can use the text boxes for the suggested purposes in documenting your BAER report, or use them in other ways. Just follow these steps:

1. Click the mouse cursor inside the largest, left text box containing "(Location Details)" at upper left of the main window;

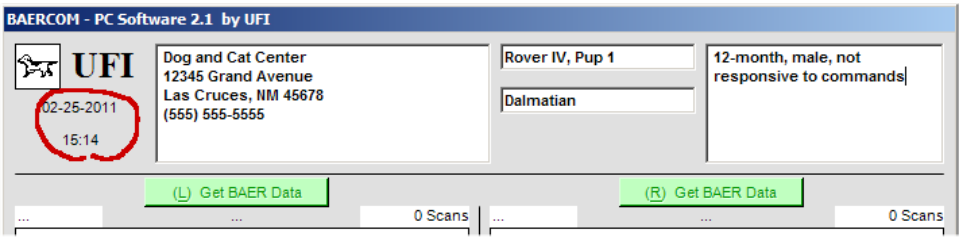
2. Delete these characters and then enter your test location and/or whatever other information you like (128 characters maximum);

3. Use your keyboard <Tab> key to move successively from the “(Location Details)” box through those with "(enter Name/ID)," "(enter Breed/?)" and "(other notes)." You can also simply locate the Mouse over the desired text box, click once, then start typing. In each box, delete the pre-loaded text, if you wish, and enter the suggested information or your own choice of text.

   The biggest (left) box holds 128 characters. The two small center boxes hold 16 characters maximum, and the large right box holds 64 characters or less.

   - For version 2.1 and earlier, note that BAERCOM-PC software ***permits you to type more characters into the boxes than can actually be saved with your data***, so if your notes tend to run long, be sure to ***check the saved BAERCOM-PC file later*** to see whether the entire text appears. You can make the needed changes if not.
   - Starting with version 2.2, you can NOT type in more than the maximum number of characters mentioned above!

   Here’s a filled-in example, using the guideline suggestions for content:



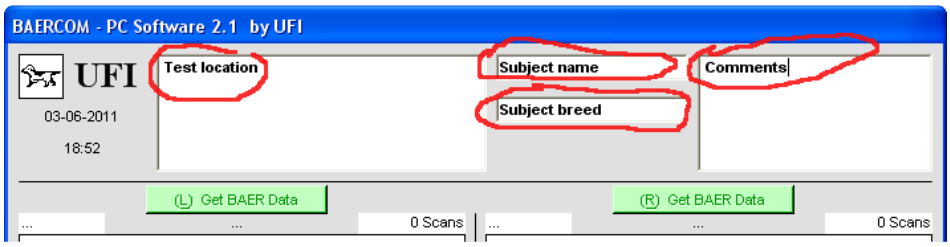
Note also that the calendar date and time of day appear just below the BAERCOM “dog icon” in the upper left corner of the main screen. These indicators serve two functions:

- When the BAERCOM-PC software is open and ready to download data, the date and time increment right along with your computer clock.
- The current date and time is saved to a computer file whenever you save a BAER report (Section 4.7), as part of documenting your test. When you use the BAERCOM-PC software Review Function (Section 4.8) to reload a report file, the time and date information are from the last time the file was saved.

4.6.3 Making a re-usable template for annotations

You may find it convenient to have a standardized format for the main window text boxes on your reports. You can come up with something similar to the example in the last section to mark boxes for test location, name, breed, and comments. Here's a way to do this:

1. Type your standardized headings into the four text boxes. Change what is there to what you would like to appear for each new report you make. You might do something like the previous example.



2. Turn the BAERCOM on and allow it to complete the normal start up sequence. Next, switch the function switch to "View" then "Collect" for just 1 Scan, then "Show", with no subject connections made. The BAERCOM unit will be in the Show mode with 1 Scan of basically flat-line data, but the data isn't important at this point. Now locate the BAERCOM unit with the BAERCOM-PC software and then direct the software to download the flat-line trace to one or both sides. Finally, save this flat-line, basic annotation report to a file as described in Section 4.7, say as a file named "template.bcd."

3. When you want to use this template with actual Baer traces taken from an animal, simply click the **Review** button (Section 4.8) and load "template.bcd." At this point, you can press the new **cta** button to clear just the trace areas! (See section 4.5.4.) Now "Locate" the BAERCOM and download two BAER traces from the BAERCOM, from the animal you are testing, into the two trace areas. ***The text fields remain unchanged*** as you add the two traces. Finally, modify the text fields to reflect the specific animal, and any other test specifics.

4. Now print or save the annotated report. If you save the report, ***be sure to choose a new file name***. If you keep the same name, "template.bcd," you will ***overwrite*** your template file! This may or may not be a problem however.

5. Note that 'Microchip' numbers are 16 digits long. Some have had issues getting this information into the two small boxes. We suggest placing this information in the 'other notes' text box to the right.

4.6.4 Using the Redraw function to restore traces

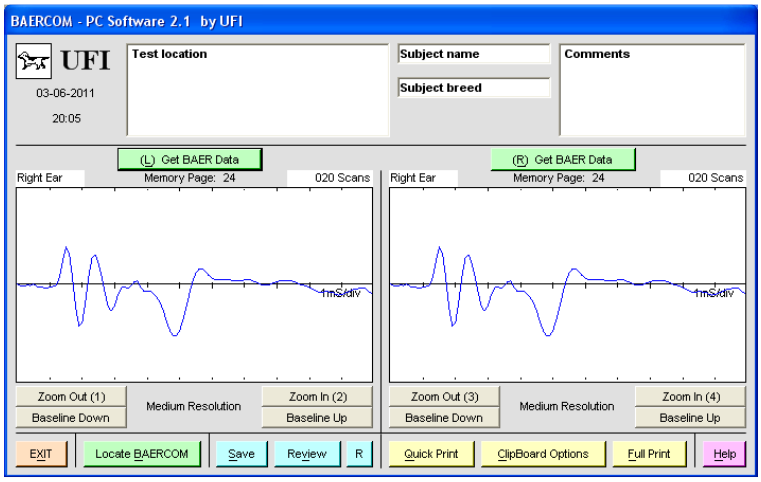
You may find that your BAER traces disappear from the main window plot areas when other program windows are used on top of it, or at other times. This disappearance is just a graphics rendering artifact. To restore any traces that were present, press the small blue "R"/"Redraw" button along the bottom of the Baercom-PC software main window. This should restore your traces.

4.6.5 Using the Zoom function with BAER traces

The BAERCOM **R/C Switch** can be set to show one of three plot resolutions – **Low**, **Medium** or **High** – on the display. BAERCOM-PC software offers the same three vertical resolutions, plus two more for plots comprised of more than 200 scans ("extended plots").

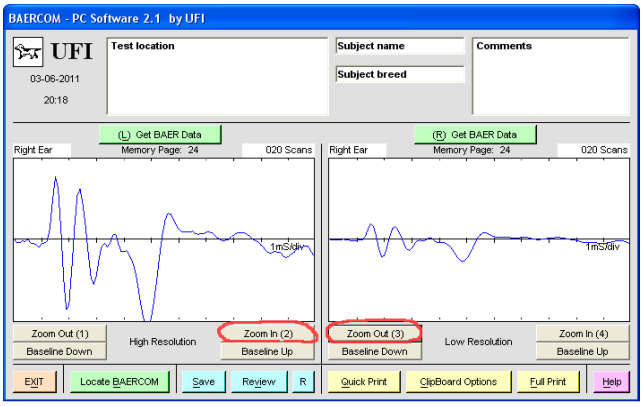
Here's how to use the BAERCOM-PC software zoom controls:

1. Download your traces into the main window plot areas (Section 4.4) to get something like the following, where we've simply used the sample data stored in BAERCOM bin/page 24 (32 for vD.2 Baercoms).



The **R/C Switch** may be set to ***any of the three resolutions***, **Low**, **Medium** or **High**, when you download – the switch setting does not change how the traces are plotted in the software. In all cases, the traces are initially plotted at medium resolution, as shown by the caption centered below each trace.

2. To enlarge the vertical scale for a trace, click the gray **Zoom In (2)** button for the left trace or the gray **Zoom In (4)** button for the right trace. To reduce the vertical scale for a trace, click the gray **Zoom Out (1)** button for the left trace or the gray **Zoom Out (3)** button for the right trace. Here's how the main screen looks if you zoom in on the left trace and zoom out on the right trace.

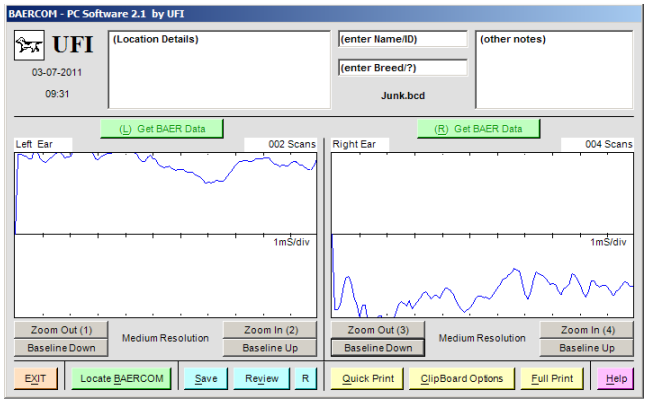


Note that the left-trace caption now reads "High Resolution" and the right-trace caption now reads "Low Resolution." Also note that the enlarged scale for the left trace ***has pushed data off the plot area*** – the bottom of the BAER trace is now clipped and invisible. Section 4.6.6 describes how to fix this problem. We recommend that you normally use the ***same resolution for both traces***, however, to make comparison easier. Medium resolution generally is optimal for small-animal tests comprised of 10-50 scans.

4.6.6 Restoring the baseline on Baer traces

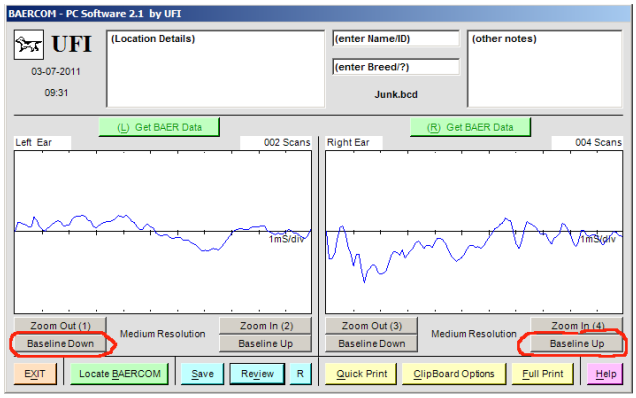
BAERCOM traces are sometimes significantly **offset** above or below the central horizontal **baseline**. Here's how to remove offset using the BAERCOM-PC software, whether you have just downloaded the trace from the BAERCOM or whether you have loaded in a report file using the **Review** button. Again, the data below is noise as we focus on how to use the software. And note also, that offset adjustments affect **ONLY** the first trace loaded in, and have **NO EFFECT** on any Mirror traces added! (This allows you to separate them for clarity.)

1. Suppose your BAERCOM-PC plots look like the following ones, where offset has been exaggerated to a point you will seldom, if ever, see in real traces:



The peaks in the left trace are clipped off severely, while the deepest ”troughs” of the right trace are cut off.

2. To re-center the left trace around the baseline vertically, click the gray **Baseline Down** button under the left trace area as many times as needed. To re-center the right trace around the baseline, click the gray **Baseline Up** button under the right trace as needed:

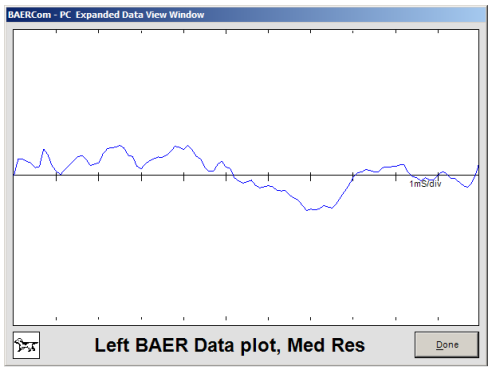


3. To retain baseline adjustments with the traces, ***be sure to save*** (Section 4.7) -- or re-save, if you've loaded data from a file -- ***your adjusted traces to a file***. Most often however, you will correct the baseline as a part of the report building process.

4.6.7 The expanded data window

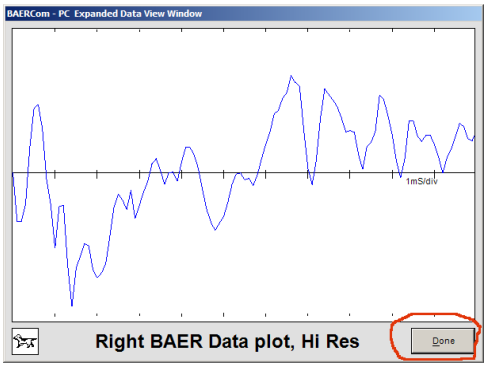
The BAERCOM-PC software allows you to enlarge your views of Baer traces, perhaps to allow closer scrutiny of the Baer traces. (Mirror traces are currently NOT included in the expanded window.) Follow these instructions to do this.

1. For the left trace, move your mouse cursor over the left trace; it changes from an arrow icon to a finger pointing up. Double-click to get this new "Expanded Data View Window":



The vertical resolution remains at the setting chosen in the main window, **Medium** in this case.

2. Expand the right trace the same way by double-clicking over the right trace (sample below). Click the gray **Done** button in the lower right corner to close the expanded data window and return to the main screen.

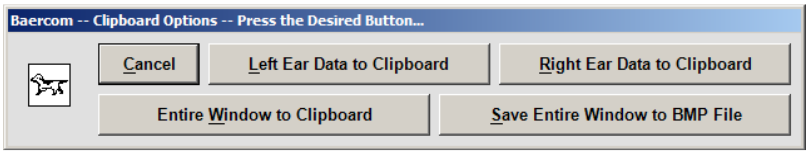


(Here, resolution was set to **High** before opening the expanded window.)

4.6.8 Moving BAER traces to the Clipboard

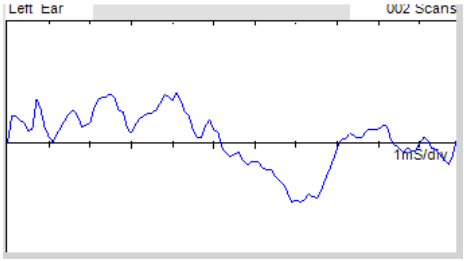
The BAERCOM-PC software permits you to export bitmapped graphic images of BAER data traces to the Clipboard for use with other applications. Here's how:

1. Plot on the main window the trace that you wish to copy to the clipboard, either by downloading directly from the BAERCOM or by loading in a saved report file. Then click the yellow **Clipboard Options** button in the lower right:

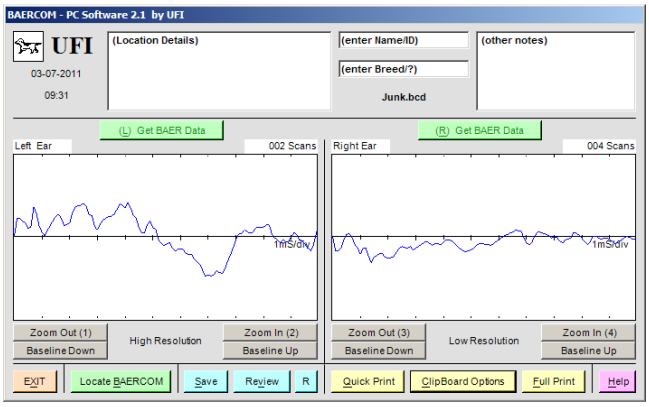


2. The "Clipboard Options" popup menu appears, giving you five options. If you press the **Left Ear Data to Clipboard** button you will see the following.

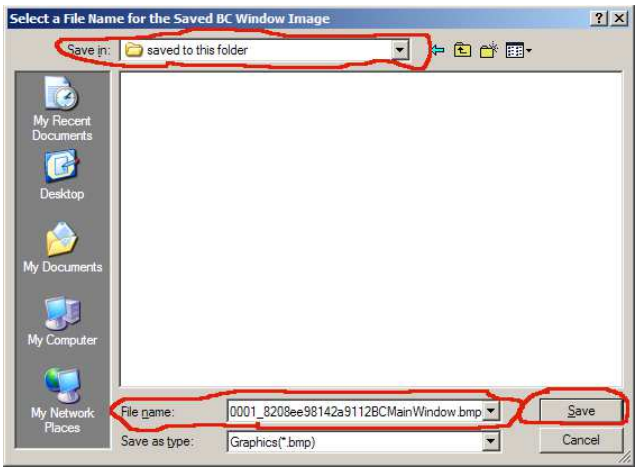
After you click **OK** on the confirmation message the following image is put onto the clipboard. (Image shown on next page.)



3. If you click the **Entire Window to Clipboard** button on the "Clipboard Options" menu, this is what you'll find an image of the main window in the clipboard.



4. If you click the **Save Entire Window to BMP File** button on the "Clipboard Options" menu, you are asked to specify a file name and a folder as the destination for the BMP file as shown (next page).



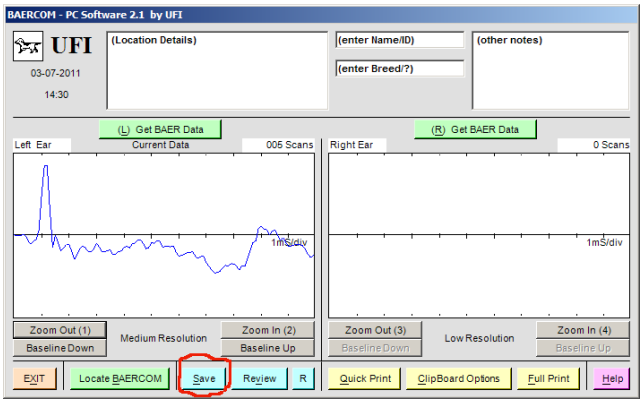
You will probably want to choose a new file name to replace the default one. After you make any desired changes, click the **Save** button. Now you can retrieve the image under the specified file name, from the specified folder, whenever needed. You can add this image to files created by many veterinary practice-management software packages, or email it as desired, among other uses.

5. Finally, just click the **Cancel** button to close the "Clipboard Options" menu and go back to the main window without taking any other action.

4.7 Saving BAER reports

We've referred more than once to saving 2 or 4 downloaded BAER traces along with annotations as a 'report', and this is a crucial operation. Generally, you will first download two Baer traces to the trace areas on the main window (Left and Right ear traces), and optionally add Mirror traces to both. Next, change / enter information in the four text areas to complete the report. More often than not, it will be this complete report that you will want to save! Follow these steps to accomplish this.

1. As soon as you've downloaded BAER data to ***at least one BAERCOM-PC plot area***, the blue, bottom-row **Save** button becomes active on the main window.

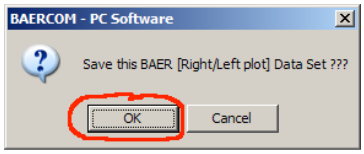


2. As mentioned above, you will probably want to complete a report before saving. You can do any or all of the following:

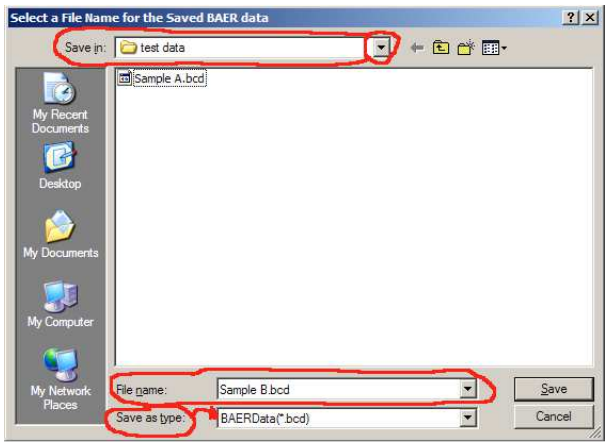
   - add a second BAER data trace (if not done yet)
   - add any Mirror traces desired

- add annotations in the text boxes (Section 4.5.2) – date and time are added automatically
- zoom both plot(s) to a different resolution if desired (Section 4.5.4)
- adjust the trace baseline (Section 4.5.5) if needed

3. When you are ready to save the report, click on the **Save** button, then click **OK** on the following message to confirm your intention to save the report to a file.



4. A new window opens, captioned "Select a File Name for the Saved BAER Data" (image shown on next page). Type a new name into the "File name" box at the bottom, overwriting the default file name supplied, but KEEP THE EXTENSION (".bcd") while you type in the new name in front of it. The "Save as type" box below should still read "BAERData(*.bcd)" and should not be changed. And remember, if you loaded in a template file at the start to initialize the text areas, be sure to change the file name to avoid over-writing your template file!

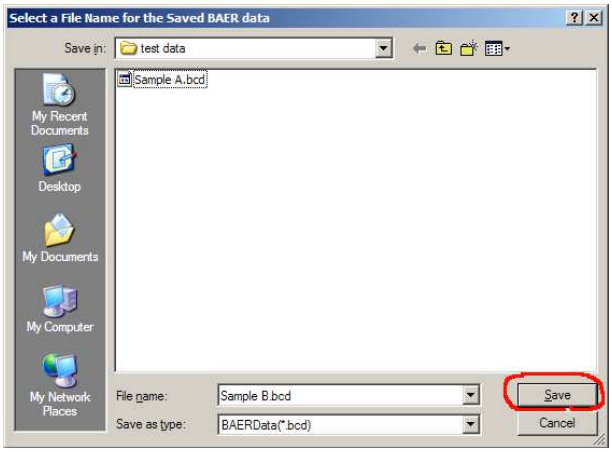


You may select an *existing file name* in the "save as" box, but if you do, the new data *overwrites the old report file data*.

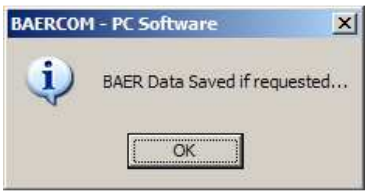
Newer operating system versions will supply the extension ".bcd", but some older versions may *not*. If the file name you type into this box *does not* include the .bcd extension, you will have a hard time finding the report file later.

Unless the folder to which you want to save your file already appears in the "Save in:" box, click on the ▼ button at the right side of the box to expand the directory tree. (You may need to use the "Up One Level" icon as well.) Then click through the tree until the desired folder shows in the box and/or use the "Create New Folder" icon to do just that.

5. Finally, with the folder and file name set, click on the **Save** button near the lower right corner of the window.



Next, click **OK** on the save confirmation message.



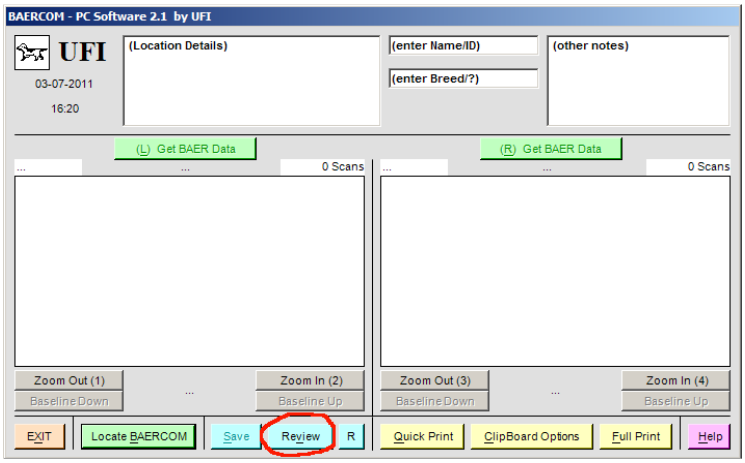
After you save a report file, you may realize that you need to change your annotations, change the zoom level, or adjust the baseline. If so, just reload the same report file, make the changes, then resave the file with the same name. The modified report file will replace the old one.

Also, the first time you save a report file to a new folder, load it back in just to make sure you can! Sometimes, the operating system may 'write protect' a folder, and this needs to be addressed before you continue to use that folder. You will need to look at the *properties* for that folder, and allow write access for that folder. Sometimes, administrator permission is required for this task.

4.8 Reviewing previously recorded reports

If you would like to examine, modify or print a saved BAER report file, simply open it in the BAERCOM-PC software.

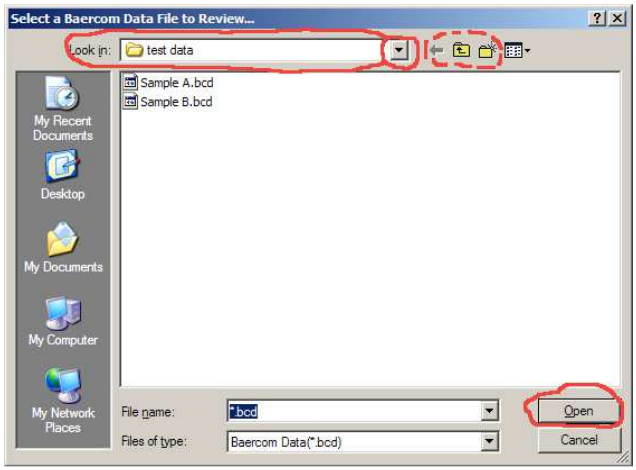
1. After starting the BAERCOM-PC software (Section 4.2), click the blue **Review** button in the bottom row of the main window.



This action will over-write any information already showing (text and traces), so click **OK** on the confirmation message if you want to do this (next page).

2. A window opens, captioned “Select a BAERCOM Data File to Review”.

[Image shown on next page.]



Navigate to the report file you wish to open -- simply click on the file name if it is located in the current directory. Otherwise, click on the ▼ button or one of the icons to the right of the "Look in:" box near the top of the window to find the file you wish to open, then click on the file name.

3. When your file appears in the "File name:" box near the window bottom, click the **Open** button in the lower right corner. Your saved report file opens in the BAERCOM-PC main window. The main window now displays the file name below the two small text boxes. The date and time of the last time the file was saved are shown under the "dog icon" at the upper left of the screen. The trace and text information is pulled from the report file and added to the main window as well. The report should look just like you saved it, an you can print it or copy it to the clipboard as desired.

4.9 Printing BAER traces / reports

The BAERCOM-PC software provides two ways to print a "hard copy" of BAER report data, "Quick Print" and "Full Print." The report may be traces just downloaded from the BAERCOM, or data from a report file, loaded in with **Review**.

Note that both Print methods now place a screen image in the Clipboard as well! Note also that any Mirror traces added will show for both print methods!

4.9.1 Quick Print method

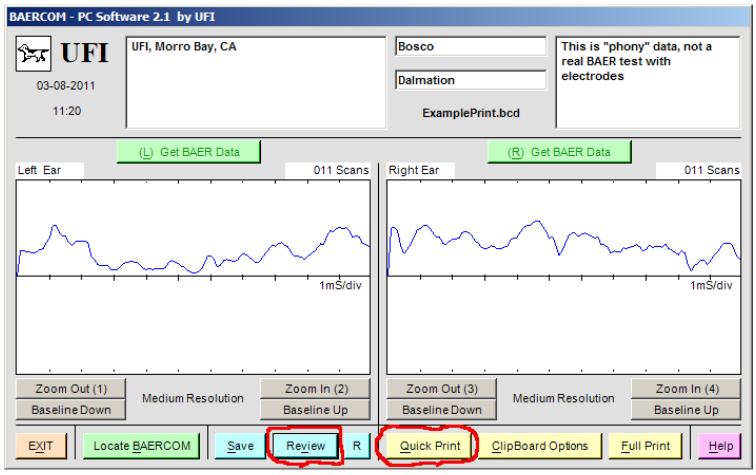
"Quick Print" permits you to print a modified version of the entire BAERCOM-PC software main window with all your report information, rapidly and without using much printer ink or toner. Some slight re-arrangement of the fields is performed, colors are adjusted, and a Signature/Date line is added, for a true report layout.

Version 2.1 of the BAERCOM-PC software also attempted to rotate the image so that it is printed with Landscape orientation. Software version 2.2 makes no such attempt, so some users may want to actually set their printer up (via the Printing Preferences page) for Landscape use ahead of performing the print.

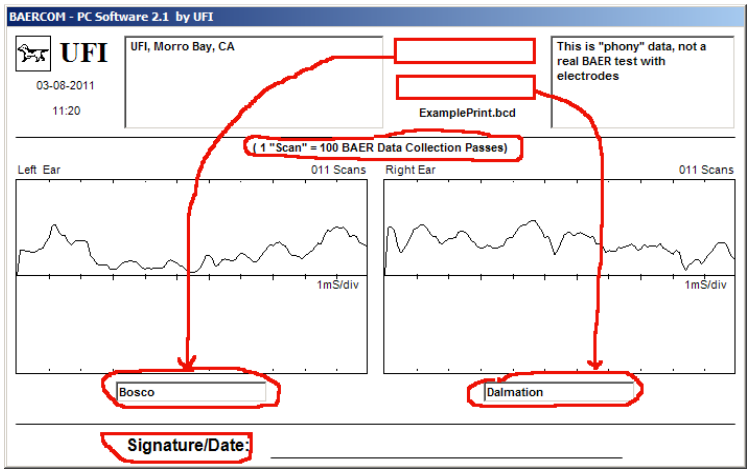
You may need to check the "Scaling" preference for your printer. If the image is way too large, uncheck the option that fits the image to the paper, or, if your printer allows, select manual scaling at 100%. Since Portrait uses less ink, you can also try reduced scaling (80% maybe) to avoid clipping the window.

To perform a Quick Print of the Baercom-PC main window, along with your report information, you can follow these steps.

1. Turn on your printer, then make sure that the report data you wish to print are displayed on the Baercom-PC main window. In the example below, we've used **Review** to load a file called "ExamplePrint.bcd".



2. Click the yellow **Quick Print** button in the bottom row on the main window to reformat the window and print your report. The reformatting performed is shown on the next page.



This reformatted window is shown only briefly. However, note how this "Quick Print" window differs from the regular main window.

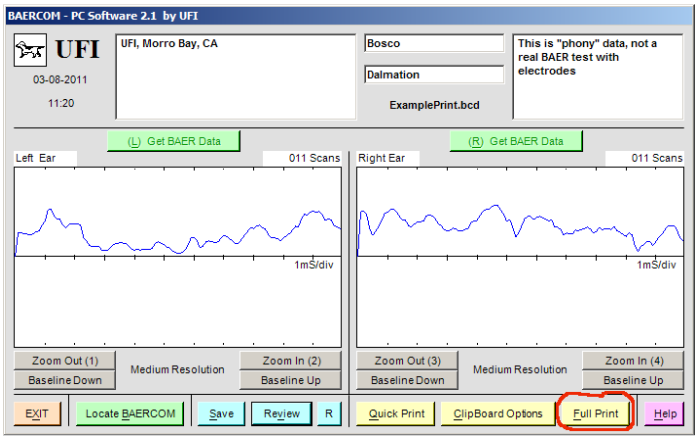
- the gray window shading is removed, replaced by white to conserve your ink or toner;
- the bottom row of buttons is removed;
- the two small text boxes are relocated:
  - the top box is moved under the left plot area;
  - the bottom box is moved under the right plot area;
- a line is added at the bottom for a dated signature for use as a legal document;
- the caption "1 'Scan' = 100 BAER Data Collection Passes" appears above the plot areas.

After the contents of this window are printed out, the main window is reformatted to appear as it normally does.

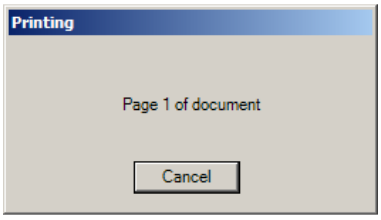
4.9.2 Full Print method

"Full Print" allows you to print the entire main window, including your report information, ***just as it appears on your monitor***.

1. Turn on your printer, then make sure that the report data you wish to print are displayed on the main window. In the example below, we've again used **Review** to load a file called "ExamplePrint.bcd."



2. Click the yellow **Full Print** button in the bottom row on the main window and you will see a "Printing" progress message.



As mentioned above, version 2.1 of the BAERCOM-PC software attempted to rotate the image so that it is printed with Landscape orientation, so that none of the window image is clipped. Software version 2.2 does not do this, so some users may need to actually set their printer up (via the Printing Preferences page) for Landscape use ahead of performing the print. You may also need to check to make sure that the "Scaling" preference for your printer is set back to 100%, or that Manual Scaling is disabled, if the image still looks too large for the print window. Again, this scaling capability may allow you to use Portrait.

Even though the main window appearance does not change, the software will still send a copy of the window to your printer.

This note applies to **both** print methods. For most printers, the resulting print image will be 'clipped' with the printer setup for 'Portrait'. As mentioned above, you can change the print to 'Landscape' to rotate the image so it is not clipped. Also, if your printer driver provides this, you can leave 'Portrait', then adjust the 'scaling' factor (start with 80%) so the image is not clipped. This will allow the image to be printed out on a half-sheet of paper should this be desirable.

Section 5: BAERCOM Typical Use Overviews

This section seeks to pull together the information and activities covered previously in these instructions. Since the contents of this section build on the previous sections, please carefully review the previous sections first. And note that the addition of **Mirror** traces can be easily included in these approaches!

Also, this information should not be viewed as a definitive approach. We anticipate that you will want to carefully adapt these suggestions into a protocol that is best suited for your practice, facilities, work area and animal populations.

5.1 Suggested initial work-flow

As you grow in your understanding of the capabilities and limitations of the overall BAERCOM system, you will probably come up with a "work-flow" that best suits your requirements. However, as a starting point, we can offer the following suggestions.

It is probably best to decide on a few basic assumptions before you actually start building your own BAERCOM use work-flow.

a. As mentioned a number of times, you need to decide at the outset what **Right** and **Left** really means – whether from the animal's view (preferred) or from your view. This basic assumption needs to be **consistently** applied.

b. It is probably best at first to separate the **animal oriented** tasks (connection and BAER trace collection) from the **PC connected** tasks of BAER trace downloading and final report generation. Arranging tasks this way allows you to focus on one *skill-set* at a time – first using the BAERCOM with an animal, then later, using the software to build the report. This approach **assumes** the use of the BAERCOM's internal memory, and you will need to always save BAER data traces as you collect them. (Remember however, that you can easily "collect" multiple BAER traces, to make sure the Baer is consistent, before actually saving one.) The use of the BAERCOM's internal memory also **REQUIRES that you carefully document** which internal memory PAGES go with which animal! This approach also incorporates our recommendation that the USB cable NOT be connected to the BAERCOM during BAER data collection.

c. To simplify your record keeping, as you use the BAERCOM unit's internal memory, one approach is to try to save LEFT ear data in ODD pages, and RIGHT ear data in EVEN pages (or vice versa). Adding **Mirror** traces means a set of four traces for each animal, so you can try to always save traces in sets of four, using the same arrangement each time. Perhaps you can always save the two Left traces first, then the two Right traces, and always placing the first animal in pages 1-4, then the second animal in pages 5-8, etc. Consistently grouping animal data using the same arrangement every time can simplify your record-keeping when using the Baercom's internal memory. And deciding how to handle this ahead of time can minimize confusion.

d. Especially if you are testing a litter of animals, you will need to make sure you have enough room in the Baercom internal memory for the animals you will be testing. In addition, it might be helpful to perform the Erase process right before use, instead of right after making the reports, which increases the chance that an error in a report gets caught while the data is still present in the Baercom. So it might be best, at first anyway, to actually perform the Baercom Erase process right before you need to use the Baercom for the next animal / litter, and you will need to set aside time for this. And by the way, the **single action full erase** supplied by the vD.2 Baercom firmware will save a lot of time no matter when you actually do the erasing!

With the discussions above in mind, we can suggest the following 'starting point' basic work-flow for your BAER trace collection, two traces per animal. Note that this work flow can easily be expanded for multiple animals, but the BAERCOM unit internal memory will only support up to 11 (up to 15 with the vD.2 firmware) animal BAER trace sets (two traces per animal). If you add Mirror traces, you will need 4 traces per animal, and could save the first animal in M01-M04, the second in M05-M08, etc. With the vD.2 firmware, you can record 7 animals, 4 traces each.

Animal focused tasks

a. Carefully follow the directions in section 2.4.2.3 (2.4.2.4 for vD.2 Firmware and Full Memory Erase!) to erase enough trace pages in the Baercom for the animal(s) you will need to test. If you will be manually erasing traces one at a time, leave enough time for this rather tedious task.

b. Carefully follow the directions in section 2.3 to connect electrodes to and place the Earphone on your animal. Set the Ear Select switch to Left, and place the Earphone in the Left ear.
c. Carefully follow the directions in section 2.4.1 to collect a BAER data trace for the Left ear of your animal. Feel free to re-run the collection process if the signal looks noisy or the animal is squirmy, or if you want to try more Scans, or whatever. Remember, if it is the Baer you are seeing, it will be almost the same each time! Performing multiple Collections to verify consistency makes sense.
d. When you are happy with the BAER trace collected for the Left ear, follow the directions in section 2.4.2.1 to save this trace in the next available page of the BAERCOM memory (maybe "M01"). You can't control which page this is except by making sure that the first available memory page you want is erased. (Collect and save a Mirror trace for this same ear now if you wish.)
e. Move the Ear Select switch to Right, and carefully move and insert the Earphone into the animal's Right ear.
f. Carefully follow the directions in section 2.4.1 to collect a BAER trace for the Right ear of your animal. Again, feel free to re-run the collection process if you have any questions.
g. When you are happy with the BAER trace collected for the Right ear, follow the directions in section 2.4.2.1 to save this BAER trace in the next available page of the BAERCOM unit's internal memory. (Collect and save a Mirror trace for this same ear now if you wish.)
h. When you are done testing a particular animal, carefully remove both the electrodes and the Earphone from the animal, and sterilize the electrodes if you are using re-usable needle electrodes.
i. Carefully record in a log book which BAER trace memory pages go with the animal just tested, e.g. "animal1 – M01(L), M02(R)" or something similar. With Mirror traces added, this could read "animal1 – M01(L), M02(L), M03(R), M04(R)" if this is how you saved the four traces.
j. You may want to come up with an unobtrusive way of marking the animal just tested, perhaps using an indelible marker to make a mark inside the fold of the ear or something similar. The marking may also include a unique number that can be referenced by any print-outs you make as well. The last few digits of a Microchip number can also be used. This step will be at your discretion, but marking animals after testing can prevent confusion when testing a large number of animals.
k. [You can repeat steps b through j above for additional animals if desired.]

BAERCOM-PC software and computer related tasks

[These details handle individually downloading traces.]

l. Start your computer, then bring up the BAERCOM-PC software. Make sure a USB cable is connected between the Baercom and your computer.
m. Follow the directions in section 2.4.2.2 to direct the BAERCOM unit to post for Review (on the BAERCOM unit LCD) the first saved BAER data trace (page), presumably for the Left ear of the first animal whose report you wish to create, annotate and save. Make sure when you are done with this step that the BAERCOM unit function switch is in the SHOW or REVIEW position, and the desired page/trace is showing. Recheck your records to make sure.
n. On the software, Perform the 'Locate' process first, if necessary or if not yet done. Then follow the directions in section 4.4 to now download the (single ear) BAER trace from the Baercom to the BAERCOM-PC software. If the trace is for the Left ear, load it into the trace area on the Left side of the software main window. Also check to verify that the trace on the BAERCOM LCD matches the trace just downloaded to the BAERCOM-PC software trace area. (Consult section 4.5.1 if you want to add an additional, Mirror trace.)
o. Follow the directions in section 2.4.2.2 to direct the BAERCOM unit to post for Review (on the BAERCOM unit LCD) the next saved BAER data trace (page) presumably for the Right ear of the first animal whose trace you wish to create, annotate and save. Make sure when you are done with this step that the BAERCOM unit function switch is in the SHOW or REVIEW position, and the desired trace is showing. Recheck your records to make sure.
p. Follow the directions in section 4.4 to now download this (single ear) BAER trace to the BAERCOM-PC software. If the trace is for the Right ear, load it into the data area on the Right side of the BAERCOM-PC main window. Again, quickly verify that the data on the BAERCOM LCD matches the data just downloaded to the BAERCOM-PC software data area. (Consult section 4.5.1 if you want to add an additional, Mirror trace)
q. After both ear traces have been added to the two data plot areas, you can now follow the directions in section 4.6 to adjust offset and zoom, and especially to add any necessary annotations to the BAERCOM-PC main window text boxes, if you haven't already done so. Make sure the particulars for the annotations reflect the specific animal that the report is for!
r. Follow the directions in section 4.7 to now save the overall BAER report to a unique disk file on your computer.
s. From here, you can print or save as a BMP file for emailing – whatever is required for your use.
t. [You can repeat steps m through s above for additional animals if desired.]

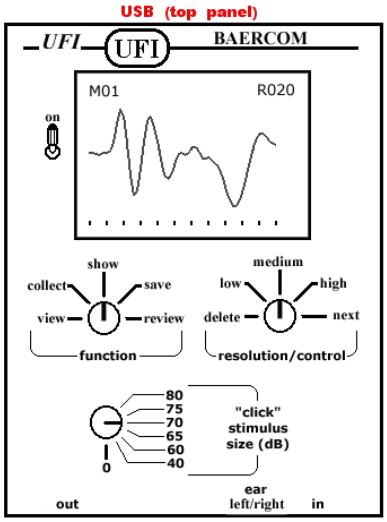
Preparation for your next testing

u. Prior to performing more testing, you will need to follow the directions in section 2.4.2.3 to Delete previously saved BAER data. Deleting a substantial number of individual BAER data pages can be a tedious process, but must be done in order to prepare the BAERCOM for your next BAER data collection session. As mentioned above, using the single action **Full Memory Erase** capability of the vD.2 firmware can save a lot of time and hassle! Also, you can perform this task after all the reports are done, or just before testing your next batch of animals, whatever works best for you.

5.2 Summary Use Examples

The 3 "Summary Use" examples below take a different approach to exercising the BAERCOM system. These examples simply walk you through some of the tasks required for the normal use of the BAERCOM. As mentioned, a firm grasp of the information in sections 1-4 supplies essential background for these examples.

A simplified view of the Baercom front panel is included below to help you quickly locate the various controls mentioned in these examples.



BAERCOM Summary Use 1: View EEG, Review Sample Data

Test the BAERCOM EEG input, view typical BAER data and adjust display size.

1. Set the BAERCOM switches, turn on the BAERCOM, VIEW data
   - Set the **Function Switch** to VIEW
   - Set the **Resolution/Control Switch** to MEDIUM
   - **Click Stimulus Size Switch** and **Ear Select Switch** can be set to any position
   - Plug **Input Assembly** into the ***four-pin*** connector on the BAERCOM (right end of lower panel), matching plug and connector alignment before engaging.
   - Connect all three alligator clip leads to the Input Assembly molded block, then the three clips to **each other** (this supplies basically 'flat line' EEG data.)
   - Pull the ***locking- toggle*** **Power Switch** away from the panel, then UP to ON
   - Four initial messages are displayed, followed by the BAERCOM posting the EEG data being sensed. This data should show a continuous nearly flat line since all 3 BAERCOM input leads are connected together.

2. Review the sample BAER data stored in the BAERCOM
   - Set the **Function Switch** to REVIEW
   - Set the **Resolution/Control Switch** to NEXT
   - Characters at upper left of **display** will show M01, M02, M03, etc. as the BAERCOM steps through the data in its trace memory data storage **"pages**"
   - Data displayed in M01 through M31 (M23) will appear as nearly flat lines, if no BAER trace data has been saved yet
   - When M32 (M24 for older firmware) appears on the **display**, quickly set the **Resolution/Control Switch** back to MEDIUM. This allows the sample BAER data saved in page 32 (or 24) to be posted on the LCD for your review
   - Set the **Function Switch** to SHOW to see the BAER data plot at MEDIUM resolution

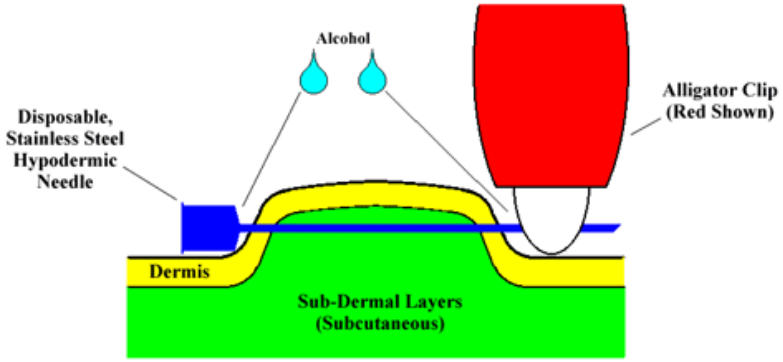
3. Adjust resolution (size) of BAER data plot
   - Set the **Resolution/Control Switch** to LOW to ***decrease*** the trace data size
   - Set the **Resolution/Control Switch** to HIGH to ***increase*** the trace data size
   - Set the **Resolution/Control Switch** back to MEDIUM to finish Lesson 1

BAERCOM Summary Use 2: Acquire BAER Data

Prepare your animal for BAER testing, then collect and save data to the BAERCOM (This assumes use of hypodermic needle electrodes. See Section 2.3.2 for full details.)

1. Attach the electrodes to your animal (this uses animal's right/left, preferred)
   - Identify the correct locations for the needle electrodes as shown below
     - ***black electrode***: on ***crown*** (top of head)
     - ***red electrode***: below ***right ear*** canal (opening)
     - ***yellow electrode***: below ***left ear*** canal (opening)
     - Right and Left electrodes should be placed where convenient directly below the Ear Canal / opening, Black electrode on the top of the head

   - Apply each needle electrode as shown below
     - Use stainless steel hypodermic needles
     - At one electrode site, carefully 'bunch' some skin together
     - Push needle electrode through skin so it makes ***subcutaneous contact***, then emerges 6mm to 10mm out the other side (1/4" to 3/8")
     - Attach the correct **COLOR** alligator clip over the ***exposed (pointed)*** end of needle
     - Apply a few drops of alcohol to exposed parts of needle
     - Repeat for the other two needle electrodes / sites



2. GENTLY insert the BAERCOM earphone into the ***left*** ear (NOT right ear as shown above); try to ***seal the ear canal*** as much as possible with the rubber ear-tip.

3. Set the BAERCOM switches, turn on the BAERCOM
   - Set the **Function Switch** to VIEW
   - Set the **Resolution/Control Switch** to MEDIUM
   - Set the **Click Stimulus Size Switch** to 70 DB
   - Flip the **Ear Select Switch (**at right end of bottom panel) to LEFT
   - Pull the **Power Switch** away from the panel, then UP to ON

4. View EEG Data: After the display shows the four startup messages, you should see a ***stable, fairly flat baseline*** with just a small amount of electronic "noise"

5. Collect the BAER response to click stimulus
   - Set the **Function Switch** to COLLECT
   - Listen for a faint clicking sound from the earphone
   - Watch as the BAER response slowly takes shape on the **display**
   - Wait until the characters "L020" appear at top right of the **display**

6. Show the BAER data on the **display**
   - When you see "L020", Set the **Function Switch** to SHOW
   - Listen as the click stimulus ***stops***
   - Observe the plot on the **display** – this is the BAER data trace you ***just*** collected
   - Set the **Function Switch** back to COLLECT, and again watch until "L020" is showing, then move the **Function Switch** back to SHOW. You have just repeated the Baer data trace collection, and the new trace should look just like the one you took a moment ago.

7. Save the BAER data to a BAERCOM memory page
   - Move the **Function Switch** one position clockwise to SAVE
   - When "STORE BAER Plot?" appears on **display**, turn **Resolution/Control Switch** from MEDIUM to NEXT briefly, then back to MEDIUM, in the time it takes to say "click, click"
   - Turn the **Function switch** back to SHOW to finish Lesson 2

BAERCOM Summary Use 3: BAERCOM-PC Software

Collect Left and Right ear BAER; download traces for both ears to your computer; annotate BAER data if you want; save annotated 'report' to a file; then print it out
[Assumes BAERCOM-PC software and USB drivers installed (Section 3) and printer available and on, and animal subject properly connected to the Baercom (section 2).]

1. Complete Steps 1 through 6 of Summary Use 2 (above) to Collect a Left ear Baer trace from your animal. **If you have just completed Summary Use 2**, and the animal is still connected, and the Baer trace you just saved in step 7 is still showing on the LCD, and the Baercom **Function Switch** is still in SHOW, and you wish to continue, you do NOT have to repeat everything above. The Left ear Baer trace you just collected is still available, so just continue to the next step (2) below.

2. Set up a USB connection between your computer and the BAERCOM
   - Check that the BAERCOM **Function Switch** is still in the SHOW position, and the Left ear Baer trace is showing on the LCD
   - Attach one end of a **standard USB cable** (supplied) to the BAERCOM **USB jack**, found at the center of the BAERCOM top panel
   - Plug the other end of the **USB cable** into any USB port on your computer

3. Download ***left-ear*** BAER data to your computer:
   - Start the BAERCOM-PC software, then click the orange **OK** button in the lower right corner of the welcome window; software main window now appears
   - Click the green **Locate BAERCOM** button at lower left of main screen to allow the software to 'Locate' the USB link between BAERCOM-PC software and the BAERCOM unit. Verify that the software 'found' (Located) the Baercom BEFORE continuing. When the software asks if it should check for the vD.2 firmware, press NO.
   - Click the green **(L) Get BAER Data** button, then wait 3 to 5 seconds until the Left ear BAER trace collected in Lesson 2, Step 6 appears in the large left plot area, and looks just like the data trace showing on the Baercom LCD.
   - Disconnect the **USB cable** from the BAERCOM for the next few steps – this will reduce electronic "noise" that could otherwise mar right-ear data collection.

4. Prepare Baercom to collect BAER data from ***right ear***
   - Gently move earphone to subject's ***right ear***, trying for a good ear-canal seal
   - Flip **Ear Select Switch** at right end of bottom panel to RIGHT position

5. ***View** right-ear* EEG Data by moving the **Function Switch** on the Baercom back to VIEW. As with the left ear, at this point you should see a ***stable, fairly flat baseline*** with just a small amount of electronic "noise"

6. ***Collect** right-ear* BAER response
   - Move the Baercom **Function Switch** to COLLECT
   - Listen for a faint clicking sound from the earphone
   - Watch as the BAER response takes shape on the **display**
   - Wait until the characters "R020" appear at top right of the **display**

7. When you see "R020", Move the **Function Switch** to SHOW
   - Listen as the click stimulus ***stops***
   - Observe the plot on the **display**, this is the right-ear trace you just collected
   - Set the **Function Switch** back to COLLECT, and again watch until "R020" is showing, then move the **Function Switch** back to SHOW. You have just repeated the Baer data trace collection, and the new trace should look just like the one you took a moment ago.

8. Download ***right-ear*** BAER data to the Baercom-PC software
   - Keep the **Function Switch** set to SHOW
   - Reconnect the **USB cable** to the BAERCOM
   - Click the "Locate BAERCOM" button to re-establish the link. (Select 'No' to skip the check for the vD.2 firmware.) **Press Redraw to restore Left trace.**
   - Click the green **(R) Get BAER Data** button, then wait 3 to 5 seconds until the ***right-ear*** BAER data appears in the large right plot area, and looks just like the data trace showing on the Baercom LCD.
   - You should now see Baer traces for Left and Right ears, just taken from your animal, on the two Baer trace areas of the Baercom-PC software.

9. Enter text as desired to ***annotate and document*** your test ***report***
   - Click mouse cursor inside the text box containing "(Location Details)" at upper left of the main screen
   - Delete these characters and then enter your test location and/or whatever other information you like (128 characters maximum)
   - Tab successively through, or use your Mouse to go to the text boxes with "(enter Name/ID)," "(enter Breed/?)" and "(other notes)," entering the suggested information or whatever you like (the two small center boxes hold 16 characters maximum, the large right box holds 64 characters.)

10. ***Save*** your BAER test data along with your notes
    - Click the blue **Save** button at the bottom of the main screen, then click **OK** in the pop-up confirmation box
    - Enter 6 to 12 alphanumeric characters into the "File name:" area of the (save) dialog box, which is labeled "Select a File Name for the Saved BAER data"
    - Make sure that "BAERData(*.bcd)" is shown in the "Save as type:" box
    - Specify a ***folder in which to save your file***, using the "Save in:" area at the top of the dialog box. Remember this location!!!
    - Click the **Save** button to create a file called "[YourFile].bcd" in the folder you specified

11. ***Print*** your BAER data file with notes
    - Click the yellow **Full Print** button at bottom right of the main screen
    - BAERCOM-PC captures the image of the main screen with data and notes, and prints it out. You may need to work with the Printing Preferences of your printer until you are happy with the resulting print-out.

5.3 'Direct to Report' Use of the Baercom System

For the most part, these instructions discuss the use of the Baercom where the actual Baer data traces are compiled by the Baercom, then saved in Baercom internal memory pages for later download to the Baercom-PC software for report generation, etc. Saving data in Baercom memory enforces at least short-term backup of your Baer traces, and also allows the Baercom to be disconnected from the PC during Baer data collection in order to reduce noise introduced from your computer.

If you have a lot of animals to test, the use of the memory can slow the process down. The addition of the single action full memory erase to the vD.2 firmware can help streamline this process, but earlier versions of the firmware are the more common. Still, some users might prefer to go from the Collect / Show Baer traces, **directly** to the Report, without having to deal with the Baercom memory at all (saving traces, carefully documenting the animal, creating the report, then later erasing the memory for the next time). Version 2.2 of the Baercom-PC software allows you to do this easily.

We need to include a few cautions here. This approach does require a much more efficient and careful work-flow for your overall Baer data collection. And, since no provision is made for even temporary back-up of the Baer data traces you have taken, you need to be much more careful. And, with the USB link as it stands, if you try to access the Baercom, after just reconnecting the link, and without performing the 'Locate' process first, the link may get locked out, and you may need to close the Baercom-PC software and start it back up before the USB link will work again. We don't recommend this approach unless you are experienced with Baercom use, and have already developed a good, stable work-flow.

The crux of this approach is disconnecting the Baercom USB cable during Baer data collection, then re-connecting the USB connector and performing the 'Locate' process prior to downloading the Baer trace you just collected. Version 2.2 of the Baercom-PC software clears the Baer trace areas ONLY the first time the Locate process is performed; the first time after a report file is loaded in, and the first time after the Baercom-PC software is first started up. This means that, after this first time, you can perform the 'Locate' process, then download a Baer trace from the Baercom to the software WITHOUT losing the contents of the other Baer trace area, or any of the text entry fields. Baer traces already present might disappear, but the **Redraw** button brings them back.

Some setup should be performed first. You should start the Baercom-PC software, and clear the Welcome window so just the main (report) window is showing. If you will be printing, make sure the Printer is on and operational as well. You should also either press the software Review button to load in a Template file, or else just type the information you want into the text boxes of the Baercom-PC software. The whole goal of this step is simply to do any initialization of the text fields in preparation for your Baer data collection.

From this point, the process could work as described below (next page). Feel free to fine-tune your specific approach to meet your needs. And note that the approach below can be easily expanded to collect the additional two Mirror traces, for four total, from your animal.

1. With the Baercom disconnected from the USB cable (maybe even in a different room), you would connect the animal to the Baercom (section 2), making sure the Earphone location and Ear Select switch match, then collect the first Baer data trace (COLLECT then SHOW) with the Baercom.
2. After this, you can disconnect the Baercom input leads at the Baercom if you will need to move the Baercom physically away from the animal. But you **must** re-connect the USB cable between the Baercom and the computer. Next, you **must** complete the Locate process before attempting to access the Baercom. And the first Locate will clear any traces previously present, but this is the ONLY time this happens. DECLINE the check for the vD.2 firmware to skip it, since you are not using the Baercom memory at all.
3. After Locating the Baercom, download the first Baer trace into the desired side of the Baercom-PC software main window. Make sure the trace on the LCD matches the trace in the software, and repeat the download if not (rare).
4. Disconnect the USB cable from the Baercom, and if required, move the Baercom back to the animal (again, maybe even in a different room), and reconnect the speaker and input leads to the Baercom if needed.
5. Next, with the Baercom disconnected from the USB, you would move the earphone to the *other* ear, move the Ear Select switch to match, then collect the second (other ear) Baer trace (COLLECT then SHOW) with the Baercom.
6. After this, you can disconnect the Baercom input leads at the Baercom. But you **must** to re-connect the USB cable between the Baercom and the computer. Next, you **must** complete the Locate process before attempting to access the Baercom. DECLINE the check for the vD.2 firmware to skip it. The first trace will probably disappear; press the **Redraw** button to bring it back.
7. After Locating the Baercom, download the second Baer trace into the other side of the Baercom-PC software main window. Make sure the trace on the LCD matches the trace in the software, and repeat the download if not (rare).
8. You will now have two traces from one animal (presumably Left and Right ear traces) showing in the trace areas on the Baercom-PC main window. You should then modify the text fields to reflect the specific animal (litter, name, MC#, etc). When you are done, Save and Print this **report** as required.

This basic process can be repeated on as many animals as you need to test. You are moving the Baer trace data from the Baercom LCD straight to the Baercom-PC software, and so you do not need to access the Baercom memory at all. Any mistakes you make will show up immediately, and you should still have the animal connection available. If you have two people working on this (one for the PC tasks, and one for the animal connection and Baer testing), this process can move fairly quickly.

As noted above, you can easily incorporate Mirror traces into the above approach. To do this, you would just Collect two traces for each ear of each animal, and use the correct buttons to download both traces to the same trace area as the initial trace, then the mirror trace. And the only 'record keeping' required is what you would do in the text note areas of the Baercom-PC software.

Still, it might be a good idea to practice this approach ahead of time, if even on one animal. Waiting until you have a room full of puppies is NOT the best time to try this out!

5.4 Sample Memory Information Recording Formats

For most Baercom users, the Baer traces collected from animals will be saved in the Baercom's internal memory during the course of the animal connection and Baer trace data collection. At some point later, the Baercom will be connected to a PC computer running the Baercom-PC software, and the previously recorded Baer traces will be downloaded from the Baercom memory, and built into the animal specific hearing reports. This section includes two table based form approaches that can be used to organize memory information you will need to record.

This first approach makes the assumption that the animal identification is the focus of the trace memory information to be recorded during Baer testing. After entering in the identification of the specific animal, the Baer trace memory pages that hold Baer traces for that animal are added to the table. Any other notes can be added as well. And adding Left and Right ear indication next to each memory page as shown below can further simplify the overall format. Especially if you are recording Mirror traces, which amounts to four traces for each animal, this documenting approach can prove very compact. At four traces for each animal, 31 available traces accommodates just seven animals (28) plus a few extra / unused memory pages. And recording an extra trace, for any number of reasons; this table approach easily incorporates variations like this. (Example on next page.)

Animal	Mem Pages	Notes
(animal name)	**M01(L), M02(L), M03(R), M04(R)**	

This next approach amounts to a linear list of the 31 available memory pages that the Baercom supplies. The first column is the memory page number, and can be filled in, 1-31, ahead of time as a part of the form. The next column can be for animal name information, and the last column includes the Ear Select information as well as any other notes deemed helpful. While this form is bigger overall, it may be more easily correlated to the Trace Browsing window, for example. Some Baercom users may prefer this approach as just simpler and easier to use.

Memory Page	Animal Name	Ear/Notes
M01		
M02		
M03		
M04		
M05		
M06		
M07		
…..		

You will need to arrive at your own overall approach to this. Still, having some sort of already printed form ahead of time, will make the documenting process a lot easier and faster.

Appendix A: BAERCOM Specifications (vD.2 Firmware)

Number of channels	One
Audio Source	Custom piezo-electric (drive is not sufficient for bone conduction or inductive earphone use)
Click stimulus	Fixed Step, Click duration less than 1 millisecond
Click amplitude	Six settings, range about 40 to 80 dB
Audio output connector	Switchcraft EN3P3F
EEG input	Signals from two active electrodes and one reference electrode. Reusable needle electrodes are provided. Input leads with small alligator clips are also provided for use with disposable hypodermic needle electrodes.
EEG input connector	Switchcraft EN3P4F
BAER data collection	100 stimulus/response passes (one scan), made in about three seconds, are averaged with any previous data. The composite average is then plotted on the liquid crystal display (LCD). This cycle of scan, averaging and display update is continuous up to 999 scans. Data collection can be stopped at any time to finish the BAER test.
Data collection interval	11 milliseconds following each click stimulus
Repetition rate	One stimulus/response pass each 25 milliseconds
BAER data storage	Up to 31 BAER tests can be saved in non-volatile internal memory “pages”. Saved BAER data can be reviewed with the BAERCOM itself (stand-alone mode) or downloaded to a PC with the included BAERCOM-PC software.

BAER data format	Two BAER data sets, along with various headers and text information, encoded as decimal ASCII
PC connector	USB Type “B” jack
PC computer interface	Isolated USB
Power source	9V alkaline battery, Type MN1604
Supply current	<20 mA
Estimated battery life	>24 hours “on time”
Enclosure	White ABS plastic with blue silkscreen labels
Case size	1.5” x 5” x 7” (35mm x 125mm x 180mm)
Weight	14 ounces (115 grams) with battery

Appendix B: BAERCOM Software / Firmware Update History

BAERCOM Firmware

11/2000 Original release.

9/2002 REVIEW function modified to keep current saved BAER data page active when switching back and forth between REVIEW and SHOW, to allow quicker page data downloading. The VIEW function sets the page pointer back to 1. (See Section 1.4.2.2 for more information.)

7/2006 Transparent update to accommodate a different processor in same family

1/2011 Rev D.1 -- Firmware updated for new processor, integrated USB

6/2015 Rev D.2 – Firmware update; expanded trace memory to 31 (from 23), added single action Erase All command, added support for PC Software v2.2.

BAERCOM-PC Software

1.3 Original production release

1.4 BAER data baseline adjustment added. (See Section 4.5.6 for more information.)

1.5 The two larger text boxes now use a smaller font, and can handle five lines of text instead of four. (See Section 4.5.2 for more information.)

Added "Quick Print" function, which uses less printer ink or toner and prints much faster than the “Full Print” function. (See section 4.9.1 for more information.)

1.6 Internal development version.

1.7 Changed COM port scanning to include COM1 through COM8.

1.8 Internal development version.

1.9 Added ability to copy entire BAERCOM screen to clipboard.
Added ability to save entire BAERCOM screen as an image file.

2.0 Rewrote code in Visual Basic.Net. Added **R** button and redraw function., color-coded many of the main screen buttons

2.1 Changed over to "Direct USB" interface, eliminating need to check or adjust Com Port setting.

2.2 Simplify handling of Trace data as well as the Text Fields. Unlock printer orientation for printing. Add entire Trace Data Download and Trace Browsing capability as well as Trace Stacking window (both only work with v D.2 Baercoms). Add Trace Mirroring allowing a second trace to be added to the software trace areas.

Appendix C: BAERCOM Simulator Use

Overview

The Baercom is a sophisticated yet portable device that repeatedly presents a "click" stimulus to the Ear, and then successively collects the EEG signal for a brief period of time following each stimulus, and sums together the successive EEG signal tracings. This is how BAER data is usually collected, and the Baercom uses this approach as well.

The Baercom Simulator is an optionally purchased accessory for the Baercom system. It is designed to replace the Ear and EEG Electrode connections on a live subject, and to mimic the response of the EEG when presented with successive "click" stimuli from the Earphone. The electronics in the Baercom Simulator actually detects the "click" stimulus, and then generates a carefully timed, very low level EEG signal corresponding to an actual BAER tracing. This allows the Baercom to be "exercised" without having to connect an actual subject.

Late in 2015, we redesigned the Baercom Simulator into a substantially smaller enclosure. The new version adds a small red LED to the front panel, for both power on and low battery indication. And the location of the various controls and connections have been rearranged to accommodate the smaller front panel. The overall function of the revised simulator is otherwise identical. These brief notes about using the Baercom Simulator have been expanded to cover both versions.

Use

The Baercom Simulator is provided mainly to meet the needs of the following two situations.

a. During your usual use of the Baercom, you may run into a situation where you suspect a problem for some reason. You can use the Baercom Simulator to quickly "check-out" the Baercom leads and data collection process to verify whether or not there is a problem with the Baercom. The "Quick Test" below can be used for this purpose.

b. Before even connecting an animal subject to the Baercom, it might be helpful to use an "artificial subject" to allow you to focus on the mechanics of the use of the Baercom system, as you "come up to speed" with the Baercom. You can use the Baercom Simulator as this "artificial subject" to help you more easily gain familiarity with the use of the overall Baercom system. The "System Test" below can be used for this purpose.

Baercom Simulator Connections and Controls

The Baercom Simulator is designed to be easy to use, just like the Baercom. The discussions below cover both the earlier, larger enclosure, as well as the revised, smaller enclosure.

1. 9V Battery

The Baercom Simulator is powered by a 9V Alkaline battery placed in a "battery pocket" on the bottom panel of the Baercom Simulator. This pocket is along one of the short ends of the bottom panel. Sliding the cover of this pocket AWAY from the center of the bottom panel provides access to the 9V Battery and connection.

When replacing the 9V battery, DO NOT pull on the wires to remove the battery connector from the battery! Instead, place your thumb against the long edge of the battery connector and pry it away from the top of the 9V battery. Also, when re-installing the battery in the battery pocket, position the battery such that **the battery leads lay flat along the bottom of the battery pocket**, and are NOT all bunched up at one end!

The Baercom Simulator draws approximately 7 mA from the battery. Thus, a high quality Alkaline battery will power the Baercom Simulator for approximately 70 hours of "on" time.

While receiving a "click" stimulus, the Baercom Simulator actually checks the level of the 9V battery. When the battery voltage in the simulator with the large enclosure drops to approximately 5.0V, the internal beeper will begin to beep every 2 seconds indicating that the battery should be replaced. The simulator stops generating Baer data when the internal beeper starts beeping.

The smaller enclosure has a red LED on the front panel. When the battery voltage drops to approximately 4.0V, the LED starts blinking on for about one second, then off for about one second, indicating that the battery should be replaced. The simulator stops generating Baer data when the LED starts blinking.

2. Power Switch

This red handled toggle switch applies power to the Baercom Simulator when the handle of the switch is toggled "up". When first turned on, the large enclosure Baercom Simulator will "beep" twice from the internal beeper, and is then ready to use. The small enclosure simulator will blink the LED once, then hold it on steadily. The simulator is ready for use. To preserve the 9V battery, you should turn the power switch off (down) when not using the Baercom Simulator.

3. Baercom Earpiece Audio Input

This round flange is located on the Baercom Simulator front panel, above (large enclosure) or below (small enclosure) the power switch. This flange is the same size as the white flange used on the Baercom Earphone. A short, rubber tube is included with the Baercom Simulator that should slide easily over both the audio input flange on the front panel of the Baercom Simulator, and the Baercom Earphone flange.

Note that you will need to first CAREFULLY remove the soft rubber tip from the Baercom Earphone BEFORE sliding the Baercom Earphone flange into the rubber tube on the Baercom Simulator. You also might want to clean the rubber tip with alcohol while it is off. Placing finger-nails on opposite sides of the white flange where it mates to the black Earphone body while removing or installing the rubber tip; this can help avoid accidentally pulling the flange off of the speaker body!

Note also that, in order for the Baercom Simulator to work correctly, the tube MUST be in place between the Baercom Earphone flange and the matching flange on the front panel of the Baercom Simulator! This tube supplies the audio path that allows the Baercom Simulator to sense the "click" stimulus.

DO NOT LOSE the adaptor tube! As shipped, it will be taped to the front panel of the Baercom. We recommend that it be stored in this location between uses. If you lose the tube, contact UFI. We can supply another tube for $10.

4. EEG Signal Connection

The Baercom Simulator uses these 3 standard male "snap" connectors to supply the simulated EEG signal that the Baercom is to receive. The 3 alligator clips from the Baercom Input Assembly should be clipped over these snaps. Note that each snap has a color marked above it (large enclosure) or below (small enclosure); each color should match not only the color of the alligator clip cover, but also the color label where each alligator clip lead is inserted into the multi-connector at the end of the Baercom Input Assembly.

5. Ear/Side Select Switch

To minimize the number of connections made to the subject, the Baercom uses a 3 lead connection, and actually switches two of the connections depending on which ear is being tested. The Black lead is always the "Crown" connection, which is the top of the head. One of the two Ear connections becomes the Reference, and the other Ear connection becomes the Signal, depending on which ear is being tested.

The Ear / Side Select switch above the EEG Signal Connections is used to properly route the EEG signals to the proper Baercom Input Leads. In other words, when the Baercom Ear Select switch is in the "Right" position, placing the Baercom Simulator switch to the "Right" position correctly routes the two "active" EEG signals to the Baercom input circuitry.

General Test Overview

Using the Baercom Simulator with the Baercom is not hard. After carefully removing the soft rubber tip from the Earphone, you use the included rubber tube to mount the Earphone on the simulator. Next, plug the Earphone lead into the Baercom. You will also need to plug the short, color coded alligator clip leads into the Baercom input lead, then clip the leads to the snaps on the simulator, making sure to follow the colors indicated from the simulator all the way to the color labels on the multi-connector on the Baercom input lead. The input lead needs to be connected to the input connector on the Baercom. Set the click size to 80 dB.

After this setup is complete, turn the Baercom on. For your first run, set both the Baercom and simulator ear select switches to Right. After the Baercom is done with its power on sequence, collect 10 scans from the simulator. This should result in a clean looking Baer data plot with no noise. And if you repeat this 10 scan data collection, you should see very little variation in the results.

You can now switch the simulator ear select switch to Left, and collect 10 scans again. The resulting plot should be half as big as it was before. This is because, due to the settings of both ear select switches, the simulator is only supplying half the size of the EEG signal to the Baercom. Such a configuration will not normally occur in testing. But the ability of the Baercom to sense this 50% reduction in the size of the supplied signal is the goal of the test.

If the signal plotted on the Baercom display is noisy or not repeatable, then there is probably something wrong with the Baercom input lead. If the signal is just too small, or if you do not hear the continuous stream of audible clicks from the Earphone, there may be a wiring problem with the Earphone lead or connector.

Detailed Test Procedures

Baercom Quick Test with Baercom Simulator

This test uses the Baercom Simulator to do a quick test of the overall Baercom BAER data collection process.

a. Setup for test
- -- Verify that both the Baercom and the Simulator are turned OFF
- -- Connect the Earphone between the Baercom and the Simulator
  You will need to CAREFULLY remove the rubber ear-piece present on the earphone in order to slide the earphone flange into the receiving sleeve on the Baercom simulator. Placing finger-nails on opposite sides of the white flange where it mates to the black earphone body while removing the rubber ear-piece, can help avoid accidentally pulling the flange off of the speaker body!
- -- Connect the Input Assembly between the Baercom and the Simulator electrode clips.
  Make sure that the alligator clip lead colors correctly match the colors shown on the input assembly label, and that the colors on the clips match the markings on the simulator.
- -- Turn the Simulator on -- it will beep twice or the LED will come on, then be ready to go.
- -- Set the Baercom "Click Stimulus Size" control to 80 dB (straight up)
- -- Turn the Baercom on and let it complete its usual start-up process.

b. Simulator Test -- Right
- -- Place both the Baercom switch and simulator switch to "RIGHT"
- -- Turn the Baercom R/C switch the "medium", and the Function switch to "view".
- -- Verify that the signal plotted on the Baercom LCD is basically a "flat-line" with a small amount of noise present.
- -- Turn the Function switch to the "collect" position, and collect exactly 10 scans of data.
  You will see an approximate copy of the sample data (bin 24/32) slowly grow over the course of the 10 scans. (You may note that the signal starts approximately 1-2 mS after the sample data does, but this is just due to delays in the detection process.) After 10 scans have been collected, turn the Baercom function switch to "show" to conclude the data collection process.
- -- Now set the Simulator switch to LEFT.
  [This reverses the connections for the Red and Yellow leads which reduces the SIZE of the Baer data supplied by the simulator by approx. 50%.]
- -- Turn the Function switch to the "collect" position, and again collect exactly 10 scans of data. You will again see an approximate copy of the sample data (bin 24/32) slowly grow over the course of the 10 scans, but it should only be HALF the size of the previous Baer data. After 10 scans have been collected, turn the Baercom function switch to "show" to conclude the data collection process.

[This completes the Quick Test.]

Baercom System Test with Baercom Simulator

This test uses the Baercom Simulator to do an overall test of all the Baercom electronics. Baer data is also transferred to the PC and Baercom PC Software and reviewed to test the software and PC Link circuitry as well.

a. Setup for test

-- Verify that both the Baercom and the Simulator are turned OFF

-- Connect a USB cable between the Baercom and the PC Computer. Start the Baercom PC Software.

-- Connect the Earphone between the Baercom and the Simulator

You will need to CAREFULLY remove the rubber ear-piece present on the earphone in order to slide the earphone flange into the receiving sleeve on the Baercom simulator. Placing finger-nails on opposite sides of the white flange where it mates to the black earphone body while removing the rubber ear-piece, can help avoid accidentally pulling the flange off of the speaker body!

-- Connect the Input Assembly between the Baercom and the Simulator electrode clips. Make sure that the alligator clip lead colors correctly match the colors shown on the input assembly label, and that the colors on the clips match the markings on the simulator. (The clips will NOT be moved at all for this test!)

-- Turn the Simulator on -- it will beep twice or the LED will come on, then be ready to go.

-- Set the Baercom "Click Stimulus Size" control to 80 dB (straight up)

-- Turn the Baercom on and let it complete its usual start-up process.

b. Simulator Test -- Right

-- Place both the Baercom switch and simulator switch to "RIGHT"

-- Turn the Baercom R/C switch the "medium", and the Function switch to "view".

-- Verify that the signal plotted on the Baercom LCD is basically a "flat-line" with a small amount of noise present.

-- Turn the Function switch to the "collect" position, and collect exactly 10 scans of data. You will see an approximate copy of the sample data (bin 24/32) slowly grow over the course of the 10 scans. (You may note that the signal starts approximately 1-2 mS after the sample data does, but this is just due to delays in the detection process.) After 10 scans have been collected, turn the Baercom function to "show".

-- Tell the Baercom PC software to "Find" the Baercom, then download the data currently being shown, to the RIGHT Baer data area on the software.

-- Now set the Simulator switch to LEFT.

[This reverses the connections for the Red and Yellow leads which reduces the SIZE of the Baer data supplied by the simulator by approx. 50%.]

-- Turn the Function switch to the "collect" position, and again collect exactly 10 scans of data. You will again see an approximate copy of the sample data (bin 24/32) slowly grow over the course of the 10 scans, but it should only be HALF the size of the previous Baer data. After 10 scans have been collected, turn the Baercom function switch to "show".

-- Direct the Baercom PC software to download the data currently being shown, to the LEFT Baer data area on the software.
-- You can now evaluate the two tracings. The form of the Sample Baer data plot should be fairly well defined. In addition, the LEFT Baer data plot should be approximately HALF the size of the Right Baer data plot.

c. Simulator Test -- LEFT
-- Place both the Baercom switch and simulator switch to "LEFT"
-- Turn the Baercom R/C switch the "medium", and the Function switch to "view".
-- Verify that the signal plotted on the Baercom LCD is basically a "flat-line" with a small amount of noise present.
-- Turn the Function switch to the "collect" position, and collect exactly 10 scans of data. You will see an approximate copy of the sample data (bin 24/32) slowly grow over the course of the 10 scans. After 10 scans have been collected, turn the Baercom function switch to "show".
-- Tell the Baercom PC software to "Find" the Baercom, then download the data currently being shown to the LEFT Baer data area on the software.
-- Now set the Simulator switch to RIGHT.
[This reverses the connections for the Red and Yellow leads which reduces the SIZE of the Baer data supplied by the simulator by approx. 50%.]
-- Turn the Function switch to the "collect" position, and again collect exactly 10 scans of data. You will again see an approximate copy of the sample data (bin 24/32) slowly grow over the course of the 10 scans, but it should only be HALF the size of the previous Baer data. After 10 scans have been collected, turn the Baercom function switch to "show".
-- Direct the Baercom PC software to download the data currently being shown to the RIGHT Baer data area on the software.
-- You can now evaluate the two tracings. The form of the Sample Baer data plot should be fairly well defined. In addition, the RIGHT Baer data plot should be approximately HALF the size of the LEFT Baer data plot.